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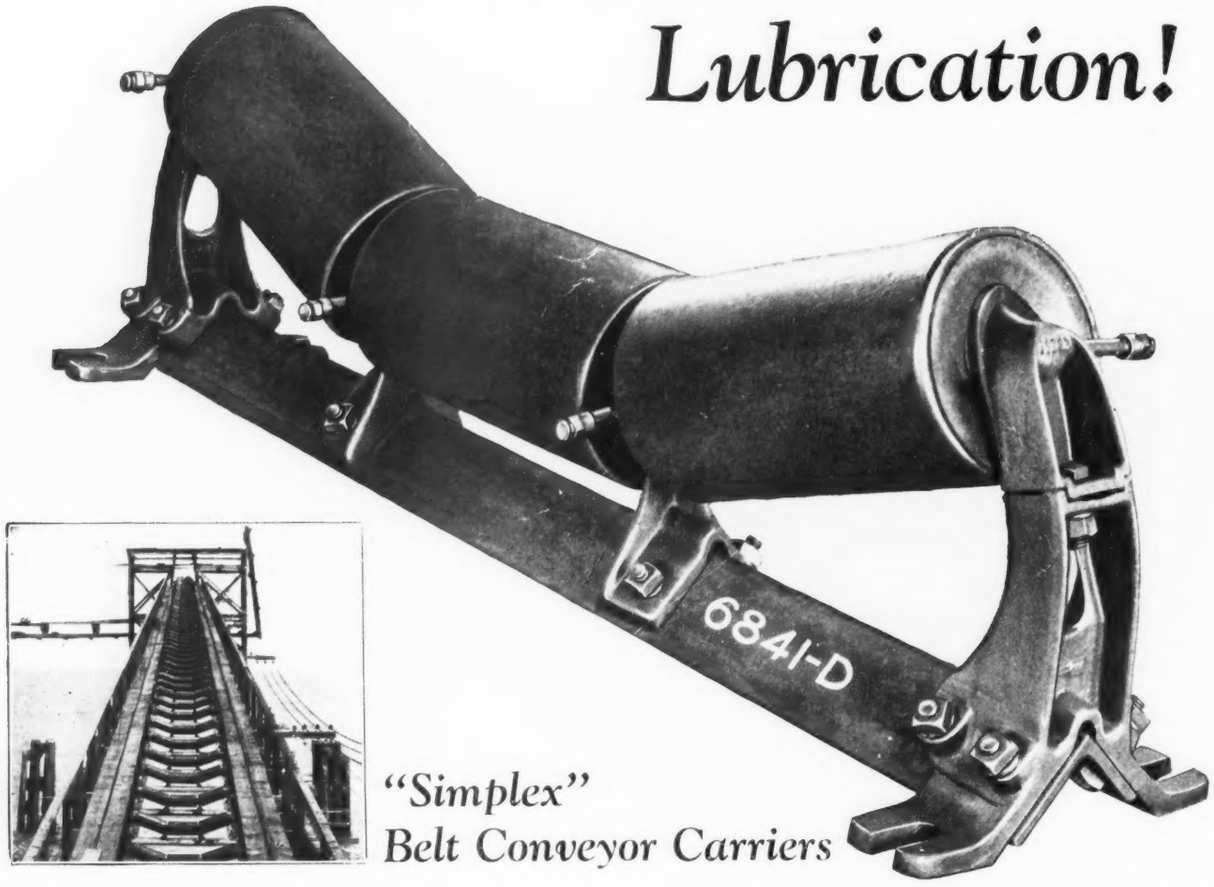

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Volume 124 New York, November 19, 1927 Number 21

ENGINEERING AND MINING JOURNAL

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In

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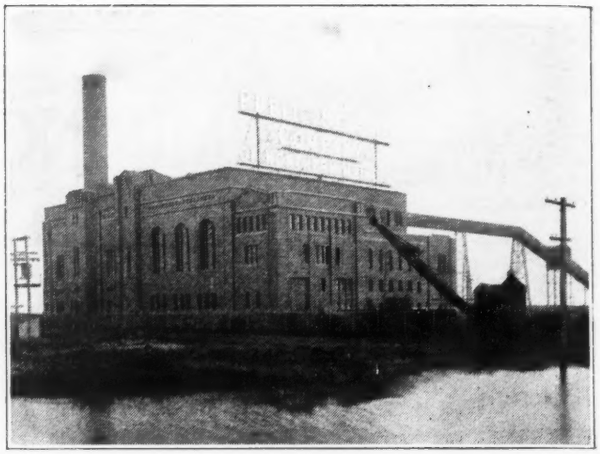

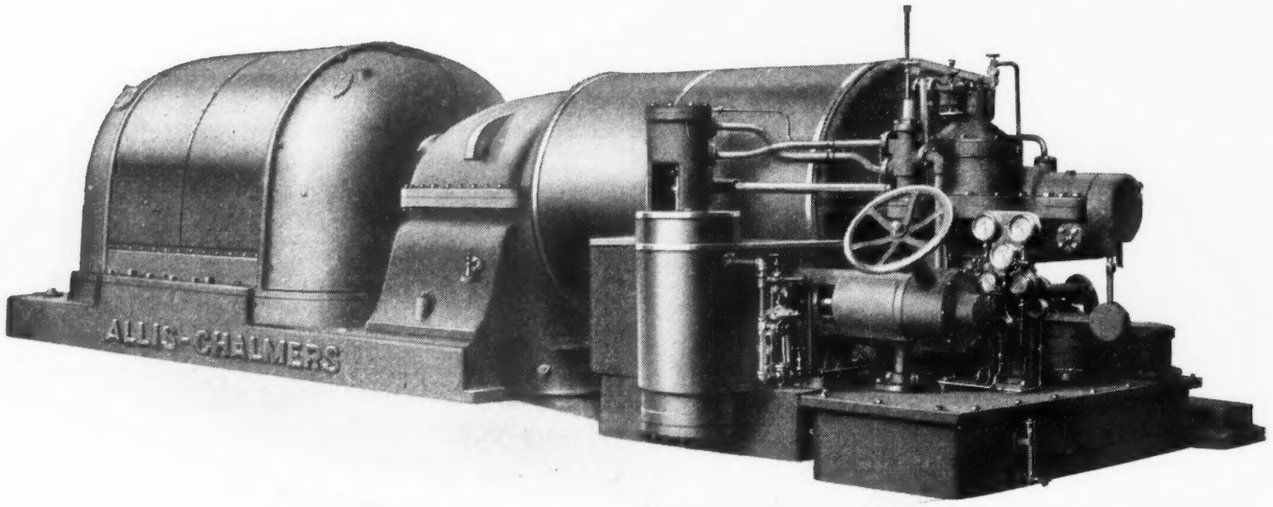

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ENGINEERING AND
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McGraw-Hill Publishing Company, Inc.
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Editor

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Launching the Copper Institute

ANYONE who either hopes or fears—depending on whether he is a producer or a consumer—that the newly formed Copper Institute will serve as a magic wand with a wave of which producers can boost the price of the metal a cent or two will be disappointed. Nevertheless, the organization is a constructive step; and if the individual producers utilize intelligently the information that the Institute will assemble and distribute, the position of the copper-mining industry should be improved.

The plan is by no means new. Scores of trade associations in the United States function in much the same way as is planned for this new organization of the copper producers; among these are the steel, petroleum, and zinc groups in the mining industry. The primary purpose of the Institute, as set forth in the constitution, will be to collect, compile, disseminate, and publish accurate information concerning industrial and commercial conditions bearing upon the production, distribution, marketing, uses, and consumption of copper ore, copper, and copper products.

At the outset the tentative program provides for the compilation each month of figures showing (a) mine production and (b) stocks of refined metal in producers' hands; each week, of sales data showing (a) the position of sellers with respect to unfilled contracts, (b) tonnage of current sales for various months of delivery, and (c) delivered prices for each of four groups of important consuming centers; and, at intervals not as yet prescribed, production-cost data, to be compiled by a firm of chartered accountants and reported in brackets starting with "less than 12c. per pound." Only aggregates or *en bloc* figures are to be distributed to the members; and these in essential particulars will be made available to the public and accordingly to consumers of copper.

Producers naturally hope in the long run to realize monetary profit as a consequence of the activities of the Institute. But this will be brought about, if at all, simply by giving producers and their selling agents an adequate and accurate picture of the position. The fact that the data will be made available promptly and frequently will enhance their value as a guide in formulating sales policies.

The important fact is that everything is to be open and above board. The authorities in Washington that are interested in such associations have been and will be kept apprised of the plans and activities of the Institute. Plans for co-operative or concerted action are not to be urged, or even discussed. No member is legally or morally accountable to the Institute for any action it may take, so there can be no "conspiracy to restrain trade." The list of officers and of the companies that already have signified their intention to join is published elsewhere in this issue. Other companies have tentatively agreed to join, and the membership doubtless will represent about 95 per cent of the copper produced in North and South America, so that the statistics should reflect the true situation.

The Institute is launched under the most favorable circumstances. Success will hinge upon the far-sightedness and fair-mindedness with which the executives of the member companies take advantage of the data that are to be made available. If the policy of "let the other fellow do it" is persisted in, however, little good can be expected from the Institute.

Africa as an Exploration Center for American Capital

AMERICAN ENGINEERS and metallurgists played an important part in the early development of the great Witwatersrand gold area, but their migration thither was not the result of a carefully prepared plan involving technical and commercial investigation and exploitation. Most of them were engaged by the various British interests operating there at the time, on a salary basis. Since then, however, the Dark Continent has emerged from obscurity and has been proved to possess many valuable minerals and metals other than gold and diamonds. The significant developments that have followed the discovery of immense bodies of copper ore in Northern Rhodesia and in the Belgian Congo have created both interest and apprehension in this country. Untapped power, in large potential amount, exists within easy reach; and this may ultimately play an important part in the establishment of electrolytic and synthetic-process plants.

British South Africa is increasing its output of asbestos at a steady rate, the interpretation of statistics of which should consider the fact that the exports are of "crude" or spinning grade, with a relatively high value. The region may yet play an important rôle as a producer of saline products. It possesses chrome ore in large quantities: Rhodesia supplied 50 per cent of the world's requirements in 1925. No lead industry of importance has been maintained to date, it is true, but this fact is of no particular significance in a survey of future possibilities. Bauxite occurs in the Gold Coast Colony, which is also an important manganese center, with increasing activity there. Producers of African mica, which is widely distributed, are seeking markets. Phosphate rock is exported in large quantities. In Rhodesia it is said that large tonnages of low-grade platinum ore await a cheap and efficient system of beneficiation; in the Transvaal, this metal has attracted much attention in late years, and technical progress is being reported—

the inevitable preliminary to economic success. What Africa possesses in potash resources is problematical. The Belgian Congo is said to hold a stock of radium sufficient to meet the world's needs for several years. Vanadium occurs in Rhodesia in combination with lead and zinc. An increasing output of tin is reported from the Belgian Congo, with announcements of discoveries in Rhodesia, a country that also possesses zinc in deposits of economic significance.

Africa is yet a young and, for the most part, an unprospected region. The metal and mineral output to date shows a progressive growth that is indicative of future possibilities. It is believed that more attention might well be paid by American exploration and development groups to the potentialities of the region, as a testing ground for technical and mechanical innovation and as a field for large business enterprise; without, moreover, adversely affecting increased interest or investment in the domestic mining industries.

The Mining or the Manufacture of Gold?

THE METAL MINER need fear nothing from the discoveries of science, but rather the reverse. His products are elements, and therefore incapable of synthesis, despite the twaddle appearing sporadically in the daily press about "synthetic gold," a metal selected for especial attention because of its lure and value. Science has indicated that by a natural process, uncontrollable by man, a base metal may be transmuted into gold; but the amount of energy required to effect the change would be out of all proportion to the value of the ultimate product. In fact, to repeat a comforting assurance, gold miners may be cheered to know that a reverse process may be the more practicable from the commercial aspect: the transmutation of gold into lead or other base metals may prove profitable because of the release of energy accompanying the change.

Metallurgists who are also students of history have long since come to the conclusion that the vaporings of the alchemists antedated scientific discoveries in the realm of transmutation that would have filled them with awe, if not skepticism, assuming that sincerity of belief was not entirely foreign to their mental make-up. This subject is discussed at length by Dr. Paul Walden in the current number of *Science*. He pertinently asks if any facts were available in olden times that might have led the alchemist to conclude that, in his chemical studies of the metallic elements, such transmutation had taken place. Or, he says, could the alchemist assume, from honest conviction and because of the possession of indicatory facts, that gold had been formed thus? Did the early alchemist really believe in the possibility of transmutation? The answer is in the negative.

The evidence available is convincing. Biringuccio, writing in the early years of the sixteenth century, scorns the idea that gold may be made thus, adding, "I would have to regard people as very clever, a sort of terrestrial angels, were I to believe that they could accomplish this." The evident skepticism among thinking men continued. In 1658, Rudolf Glauber wrote as follows: "I will not seek to prove, nor could I do so, that he (Paracelsus) made gold and silver in large quantities." He admits, with commendable openness of mind, that it might be possible to do so, but his belief in the practicability of transmutation may be gaged from the statement that "How to do so on a large scale I do not know at present, nor am I particularly interested to know."

One sees in these opinions, however, the birth of a belief that gold might be made thus in minute quantities. In this connection Dr. Walden has shown that the ubiquity of gold has been recognized since early times; although, we might add, only comparatively recently was it discovered in the soot particles hovering over a city. In the thirteenth century, Albertus Magnus taught that it is found in all minerals. This opinion was slightly modified by Biringuccio three hundred years later, who wrote that "there are few metals that do not contain a trace of gold, some more, some less." Glauber, in 1658, assumed that, in the preparation of pure silver by chemical methods, a minute amount of gold was carried over in the acid used. The real scientists of those times, therefore, were sufficiently honest in their experiments to take nothing for granted.

In recent years, a revival of interest in the possibility of commercial transmutation of a base metal into gold has occurred. In 1913, F. Soddy predicted that "If by some agency or other we could only cause mercury to expel an alpha particle (that is, a positively charged helium atom) and a beta particle (a negative electron), the product would be an isotope of gold." Since then the scientific and pseudo-scientific magazines and the Sunday supplements have been provided with occasional headline material. It was reported that weighable quantities of gold had been manufactured from mercury in Germany and in Japan. The standing of the scientists engaged in these investigations left no doubt as to their sincerity and the thoroughness of their work. But were they mistaken in their deductions? Metallurgists know, perhaps better than chemists, that minute quantities of gold are found in native quicksilver, that native gold always contains silver, and that native silver always contains gold. This "contamination" of mercury with the metal it was desired to manufacture may well have led to a mistaken conclusion, as we maintained at the time. Doctor Walden adduces interesting historical evidence that shows an anticipation, many years ago, of this interpretation of Dr. Miethe's results. Boerhaave, writing in 1727, concluded that "Quicksilver evidently shows gold in the middle or body of it, silver at the top or in the face and a corrosive at the bottom; accordingly all adepts say of mercury that it is gold at heart. . . . And hence that maxim upon mercury: Strip me of my clothes, and turn me inside out, and all the secrets of the world will come forth." Doctor Walden adeptly links the suggestions of ancient and modern times thus: "Does not the one say 'Strip me of my clothes,' whereas the other says, 'remove an alpha and a beta particle'?"

Lack of means for the detection of the infinite and for the analysis of matter occurring in minute amount has been largely responsible for the comparative slowness of scientific progress throughout the ages. It was the one dominant factor that permitted the persistence for so long of the theory of spontaneous generation of animal and vegetable life. Given an unbiased mind and a truly scientific attitude, however, the solution of many problems of the kind under discussion will depend in large measure on the development of equipment for weighing and estimating the microscopic—tools of accuracy that will seem to the layman as truly miraculous in their sensitiveness. In summary and in conclusion, however, we may affirm that the most satisfactory and most economical method of obtaining gold is to mine it.

The Trade Bulletin as a Messenger of Industry

THE fact that manufacturers' catalogs and bulletins are produced primarily for selling goods should not blind the reader's eyes to intrinsic merit. Usually they are of pleasing appearance. Of more importance than this superficial quality, however, is the informative nature of their contents. Often such publicity matter is superior to any textbook on the subject covered, and at times it provides the only source of specific information.

Among recent bulletins of particular interest in this respect is one issued by the Lebanon Steel Foundry, of Lebanon, Pa. It is the seventeenth of a series describing steps in the company's process of making electric-furnace steel castings, and deals specifically with the standardized system of inspection in vogue at the plant. "The preceding bulletins," we read, "must have impressed upon the reader the importance of the human factor in the production of steel castings." It announces that the subject of the next will be the technical department. Bulletins of this sort are valuable contributions to engineering literature.

In decided contrast, many catalogs show inexpert preparation—an amateurishness that begets no confidence in the product advertised. In some, it is hard to find the manufacturer's name, strange as this may seem; and on occasion the address is omitted. Such evidences of carelessness serve only to emphasize how neglectful some producers are of the potentiality of the catalog as a salesman, as a messenger to industry, and as a factor contributing in no small measure to technical and industrial advance.

Geophysics and Spiritualism

"SPIRITUALISTS of geophysics" is the term applied by Dr. Max Mason to those operators of electrical exploration methods who offer to do things entirely outside the bounds of known science. "They obtain messages which no others can decipher," he says. "The honest and informed physicist must admit the limitations of his science."

How broad a class this pointed humor is meant to characterize is a matter of speculation. It is all too kind to the pretenders who with curious and inexplicable devices prey upon the unintelligent. For the most part they are swindlers, but it is difficult or impossible to bring them to book for the fraud they perpetrate. Only through legal proceedings could this be done, and it is unlikely that a lay jury would make a proper distinction between the scientific and the pseudo-scientific in a matter so far beyond its comprehension.

Nevertheless, the time is near when a visible line must be drawn between those who are qualified to make geophysical examinations of mining properties and those who are not. The reason is that, as geophysical prospecting methods increase in popularity, owners of mineral claims will be more and more likely to submit exploratory work of a geophysical nature for acceptance as assessment work, required by law in the United States and Canada. Unless some safeguard is established, therefore, the resultant growth in demand for the services of physicists will be paralleled by a growth in the number of "doodle-bug" manipulators and their ilk, all fattening on ignorant and possibly dishonest claim owners. True it is that, questionable as such assessment work would be, it would be no more dishonest than much that is being certified annually to the government at the present time; this, however, is no reason why existing evils should be allowed to become worse.

How may the bogus in geophysical exploration be distinguished from the genuine and scientific? The licensing of properly accredited individuals and firms has been suggested. This might furnish a solution of the problem if it were possible to make a decision satisfactory to all as to what would constitute the proper credentials. It has also been suggested—and, indeed, is required in certain cases in Canada—that geophysical exploration be followed by drilling of the property explored if it is to be accepted as assessment work. In either case difficulties must be surmounted.

No Opportunity for Copper in Food

COPPER has no place on the table—that is, in the food to be eaten—according to researches recently conducted at the University of Pittsburgh. In the first place, it is poisonous, more than 5 to 10 grains a day being likely to produce toxic results. Second, it tends to cause disagreeable flavors. Third, it destroys Vitamen "C"; and, fourth, it often produces "off-color" food. Presumably the presence of copper in foods cannot be traced to any insidious propaganda by those seeking to extend the uses of the metal, but comes from the improper use of copper containers, sometimes the wrong kind of food being cooked in them, and sometimes the food being left in contact with the copper for too long a time. The bright green color of some restaurant peas, however, may be due to copper, used by French canners. The United States food laws prohibit its use, but control cannot extend to foreign canning plants, whose products may be imported into the country. In this case, certainly, and possibly with spinach also, copper does not produce off-color food, but is considered to result in a great improvement on Nature, like unto the effect commonly achieved on the lips of the fair maids who eat it. Free copper sulphate undoubtedly produces toxic results; it has been used as a dysentery medicine, but perhaps the investigators mentioned have not realized that the copper in peas may be adsorbed on the surface as a dye. That appreciable harm would result from their consumption is extremely improbable. It is a large subject. English courts have adjudged small quantities harmless, but the United States pure-food laws are so rigid that it is not permitted to add anything that might deceive the customer or permit a more attractive food product to be produced by means of a color or dye, without that fact being plainly stated on the label; and in some instances, as in oleomargarine, an additional tax must be paid.

Incidentally, it may be remarked that those who are seeking to expand the uses of copper have apparently not tried to influence the legion of American cooks. An occasional fleeting glance into the kitchen of a dining car, or that of a restaurant, discloses many gleaming copper utensils, but they are rare indeed in the kitchen of the American home. Here, the manufacturers of aluminum utensils seem to have had things pretty much their own way.

Dr. Alfred Merton

Head of the Metallgesellschaft and the Metallbank

Visits America

An Interview by
E. H. Robie

NO GERMAN metal firm is better known throughout the world than the Metallgesellschaft. Many mining men are familiar with this organization through its publication annually of price and tonnage statistics on various non-ferrous metals, and to them it may seem similar to the American Bureau of Metal Statistics. But the compilation of statistics is only a small part of its activities, which include, also, mining, smelting, refining, and trading in a variety of metals. In this work, it is associated with a co-ordinate company, the Metallbank und Metallurgische Gesellschaft. These two parent companies own many subsidiaries, and are in turn themselves, through partial stock ownership, associated with other metal companies.

For the last five weeks Dr. Alfred Merton, chairman of the board of the Metallgesellschaft and president of the Metallbank, has been in the United States for his first visit to this country. After meeting him, and talking with him for an hour or so, one has no reason to wonder at the great commercial and technical progress that has been reported recently from Germany, if most of the men in charge of its enterprises are of his stamp. Dr. Merton is still in his forties, with all of the youthful vigor indicated in his photograph. His command of English is superior to that of most native New Yorkers.

In talking with me, Dr. Merton first politely complimented this magazine on the manner in which it covers international developments in the mining world. "I greatly regret that we have no mining publication in Germany that approaches it," he said, "and in order to keep up to date we always have the latest issues at hand."

HAVING thus disposed of the amenities, I asked Dr. Merton for a picture of the activities of his organization. "Our mining interests are comparatively small," he explained, "our most important mine being at Meggen, in Westphalia. This is rather an unusual deposit, consisting of a large amount of pyrite associated with blende, the zinc content averaging from 8 to 10 per cent. We are now experimenting with selective flotation in the treatment of this ore, though the close association of the minerals will necessitate very fine grinding. Germany has few non-ferrous metal mines of importance, and for most of our ore we must rely on outside sources. However, as custom smelters, we have wide interests, producing copper, zinc, lead, aluminum, and tin, together with the associated minor metals. Our large zinc smelters are situated at Duisburg and Bensberg, on the Rhine; at Duisburg, also, is our tin-reduction plant, a part of the production being by electrolytic methods. At Hamburg is situated our electrolytic copper refinery, which is in process of being enlarged to a capacity of 60,000 metric tons of electrolytic copper per year. Here, copper ores are smelted, and copper is refined from many parts of the world, but more especially from neighboring countries. In Hamburg, also, lead ores are smelted. Another lead smelter is at Braubach, on the Rhine. The rolling and fabricating works of the company are near Frankfurt, at different points on the Rhine, and in Nuremberg, Bavaria.

"So far, all of our zinc is produced by the retort process, though we realize that this is subject to improvement. However, it must be remembered that retort smelters represent a large investment, and even though a somewhat more economical process may be developed (the acquisition and development of new processes constituting quite a substantial part of the Metallbank, for which purpose they maintain extensive laboratories), it may not pay to scrap the old for an equally costly new installation. One must compare the savings with the new investment. Electrolytic zinc is, of course, coming more and more to the front, and new smelting processes appear promising."

AN ATTEMPT to get Dr. Merton to predict as to what class of metal producers were likely to be most prosperous in the next few years was a total failure. "That depends, of course, upon what the prices of the various metals will be," he truly said, "and I do not pretend to be a prophet. Just now, metal prices are low, but producers are trying to cut costs to enable them to compete rather than curtailing their activities. Low prices, of course, affect the miner more than the custom smelter and refiner, and in Germany we have no great hope for the future so far as mines are concerned, the country having been pretty well gone over. However, in some other parts of Europe, prospecting has been less thorough, and as money becomes available some good mines may be developed. Electrical prospecting methods may play a part in future."

In 1913 Germany consumed 259,000 metric tons of copper, or 25 per cent of the world consumption, the United States taking 32 per cent, and other European countries 37 per cent. In 1926 Germany used only 167,000 metric tons, or 11 per cent of the world's total, the United States using 49 per cent and other European

Photo by Blank-Stoller Inc.

DR. ALFRED MERTON

countries 30 per cent. What, Dr. Merton was asked, is the probability of Germany regaining her former position as a copper consumer? "Recent figures have been much better," he replied. "Your own American Bureau of Metal Statistics shows imports so far in 1927 running at a rate above 200,000 tons a year, and we are now close to, if not quite equal to, the rate attained before the war. Of course we cannot equal the pre-war percentage, for consumption in the United States has grown vastly. Germany needs an enormous tonnage of copper both for electrical and other purposes, and for both domestic and export manufactures. Money for financing improvements and extensions of present facilities is still a great need."

This brought up a question as to the reception of American loans in Europe, the interviewer remembering that at some of the recent meetings of the Empire Mining Congress in Canada some opposition was voiced at the influx of American capital, it being felt that this brought an undesirable foreign influence into domestic affairs. Apparently no such antipathy toward American capital exists in Germany, however; it is welcomed.

THE association of American and foreign copper-producing interests, known as Copper Exporters, Inc., was then touched on. "Our membership in this organization has been very satisfactory to us," said Dr. Merton. "When it was first formed there was some opposition in certain quarters in Europe, but this has largely died down, both producers and consumers being, in general, well satisfied with the functioning of the plan." "It has not done much to improve the market," I suggested. "Who knows how demoralized it might be were it not for the association?" he countered.

"On this side, we hear that aluminum is a common substitute for copper in electrical transmission in Germany. Is it displacing copper there to a large extent?" "Undoubtedly," Dr. Merton said, "aluminum has become a popular material for high-tension transmission lines in Germany, but underground cables are entirely of copper so far as I know. The use of aluminum is partly influenced by the fact that the metal is produced in the country. Its use diminishes our needs for foreign exchange. As our imports are much higher than our exports, and considering our other heavy obligations toward other countries, this is a point of great importance for Germany." This brought up the recent rumors that the Aluminum Company of America was seeking to secure a foothold in Germany. "It may be," Dr. Merton explained, "that the Aluminum company is endeavoring to widen the field of its activities. The government production of aluminum is not subject to foreign participation, and I know of no effort of the American company to break into our aluminum producing activities. The British and French aluminum companies are strong national enterprises, and the Swiss production is under the control of the government. So, although the American company may try so far as it can to become a world monopoly, there are several hurdles yet to be jumped. Bauxite deposits are so large and numerous that there is no danger so far of anybody getting the control."

RUSSIA still presents a problem, in Dr. Merton's opinion. The country is so vast and undeveloped that it is difficult to form an opinion. Conditions are still far from their pre-war industrial footing. Germany, he said, is naturally desirous of peace and industrial activity in its next-door neighbor on the northeast, and is doing much to promote trade between the two countries.

In closing, the tariff question was discussed. "Germany" he said, "has much lower customs duties than the United States, and, furthermore, has recently arranged a tariff agreement with France that should be to the advantage of these two neighboring nations. There is no tariff on any metal coming into Germany, raw materials in general being entered free of duty."

Doctor Merton sailed for Germany on Nov. 5. He takes back with him many remembrances of the friendship of those whom he met in this country. Such international visits are to be desired for every important government official and business executive. Thus could many misunderstandings be averted.

Geophysical Exploration for Ores

PART II—CONCLUSION

By Dr. Max Mason
President of the University of Chicago

THE SECOND, or experimental, means of studying the basic detectability of ores is one which has proved indispensable in many other applications of physics. I refer especially to small-scale experimentation with models. We all know that the use of models in wind tunnels and in towing basins, for example, has contributed untold information to the science of the airplane, and to naval architecture. I believe that the use of models will play an important rôle in ore exploration. But before we can use models intelligently we must know the equations and laws which apply. The model is not simply a duplicate of the larger structure made on a reduced scale, as is sometimes thought to be the condition in ore-detection work. Account must be taken of the new values of the electromagnetic quantities when the scale is changed. In the towing of a ship model, or the test of an airplane wing in a wind tunnel, the resistance is not directly obtained through multiplying by the model scale. Similarly in ore models, where one factor, such as size, is changed, the other factors must be altered in correspondence. Models are models, but you must know how to work them.

Models, when correctly used, serve to tie together in a valuable manner the exact predictions of mathematical theory, the extensions of theory based on judgment, and the actual experience in the field. They contribute new information which might easily pass unnoticed through studies of theory and practice alone.

I think I can make their value clearer by means of illustrations. We will again take the example of a conducting spherical orebody in the presence of an inductive

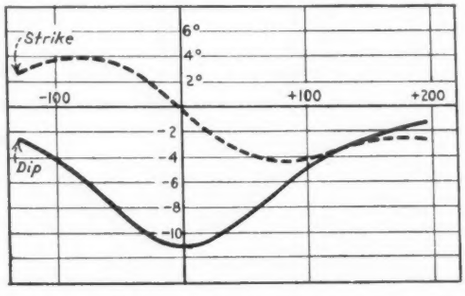

Fig. 7—Curves showing the theoretical distortion of an electromagnetic field caused by a conducting sphere

field such as we use in practice. The mathematics for this case predicts the sort of curves shown in Fig. 8. Here the sphere is assumed to be 100 ft. in radius, with center under 120 ft. of cover, composed of solid pyrite. We suppose that our line of traverse passes, not over its center, but directly over its extreme outer edge, as shown in the plan. The energizing source is assumed to be far away—2,000 ft. to the left, and of 1,000 cycles frequency. Then theory predicts the following distortion in the incident magnetic field along the traverse. The field is normally horizontal, but is caused by the sphere to dip, as shown by the solid curve, until it obtains a maximum of 11 deg. opposite the center of the sphere. The dotted curve shows the change in the strike of the incident field. This is less, amounting to about 4 deg., but it reverses over the sphere, so the total change is 8 deg., or nearly as great as on the dip. Besides the changes in direction, we will have a change in intensity of the field. In the particular traverse chosen we will get relatively small changes in intensity, but by another choice of position the intensity changes become much

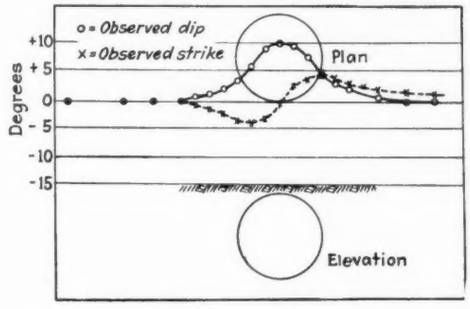

Fig. 8—A model experiment, showing the distortion of an electromagnetic field caused by a conducting sphere

more apparent. In the traverse shown, a maximum variation of only about 3 per cent is obtained.

One other factor needs to be considered, and then we have told the entire story of the response of the given sphere under the given excitation. This is the phase change which has been often mentioned in connection with electrical prospecting. However, in the case of our present problem, the phase shift is small—of about 4 deg.—and is substantially constant in value at all points within a mile of the sphere. In this particular case the phase shift cannot be regarded as the primary indication.

Now let us see whether our theoretical solution is correct. We make up a model sphere of about 3 ft. diameter and we make small-scale measurements of the strike and dip of the source field in its neighborhood. The results of these measurements are shown in Fig. 7. It is clear that the curves resemble the theoretical ones. To

show how good the agreement is, the experimental points are replotted to a large scale, for comparison with the predictions. In Fig. 9 the solid disks are experimental settings on the strike, and the circles those for the dip. The agreement is within 30 minutes at most values and is within the accuracy of the work. We see then that we are working the theory successfully and the models correctly. We have not yet, however, connected this subject with a real orebody, and I think you will be interested in seeing this next step. As an example, we shall use the Falconbridge or Longyear nickel body, in the Sudbury, Ontario, basin. It has been well drilled, and is known to be a nearly straight long sheet, of a dip of about 90 deg., and probably of great extension in depth.

At the Edison Kettle hole, its shape is shown in plan and section at the right of Fig. 10, as drawn by Hugh Roberts from the drill data. A model of this orebody

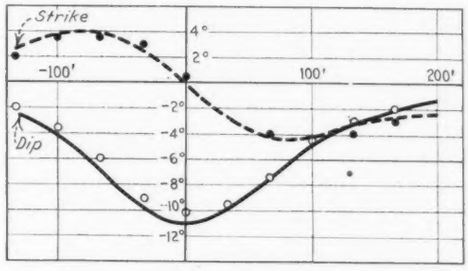

Fig. 9—Comparison of theoretical and experimental distortion of an electromagnetic field caused by a conducting sphere

was made on a scale of about 300 to 1, and of a section shown at the left. This is roughly a mean between the two sections indicated by the drill. The cover is 60 ft., the thickness of the upper lip 40 ft. and at the widest part 120 ft. With this model, the distortion of the incident inductive field was measured, and the curves shown were obtained. The solid curve represents variations in dip; the dotted one those in strike. Actual distortions obtained in the field are shown by the circles. It is seen that the model results and the actual data agree within a few degrees in most places. Moreover, by the model curves, a position for the quartzite-ore contact is indicated which agrees within five feet of the result obtained by Mr. Roberts. When we consider that the real orebody probably departs somewhat from the section assumed, the agreement is surely gratifying.

Fig. 11 will illustrate another valuable rôle of the model. This illustration is much like that in Fig. 10, and represents a small continuous orebody of similar type 500 ft. long, 100 ft. deep, and under 40 ft. of cover. Now let us suppose the ore were disseminated through a thin, perfectly insulating intrusive dike, and that the particles failed to make contact one with another. We know that under such conditions the inductive reaction would be enormously diminished, but the results of the test are nevertheless striking. Let us, for example, preserve the same amount of ore, but cut it up into small squares, each one insulated from the next. Let the squares be of generous size, for a disseminated ore—say 9 ft. on a side. The resulting response is shown in the lower curve, taken from a model experiment. The curves become straight lines, and the response is essentially nil.

I need not dwell upon the utility of the third key to

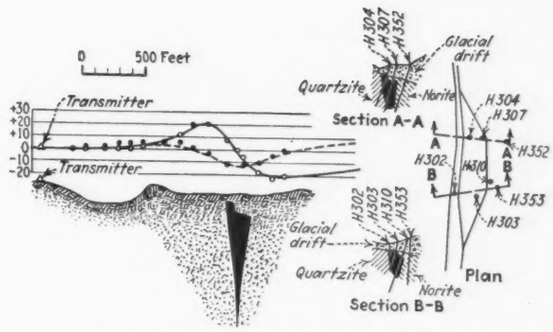

Fig. 10—Comparison of results obtained from a model with field data gained in applying the inductive method of detection to the Longyear orebody

the ore-detection problem—namely, the information to be gained from practical field experience. As in everything else, the knowledge gained from first-hand contact with the actual work is bound to be of prime importance. Comparisons of results with each of the methods I have mentioned when they are applied over the same part of an orebody have seldom been given. I would, therefore, like to illustrate by actual field data the typical responses which occur.

The orebody to be used in this illustration is the Falconbridge body. At drill hole No. 24 it has a thickness of about 30 ft., with 115 ft. of overburden, as shown in Fig. 12. In Fig. 13, the transverse component of the gravitational gradient obtained with an Eötvös balance is shown. The smooth curve is a weighted one drawn through the observed points, which are shown as circles. These points vary considerably about the curve, owing chiefly to the random effects of the large boulders of the glacial drift. In the absence of ore, the norite quartzite contact should give a symmetrical curve. The lack of symmetry in this curve may be attributed to ore, although results are not as definite as could be wished, because of the incidental variations caused by the presence of boulders. The curve in Fig. 14 illustrates the detection of this ore by the magnetic dip needle. Here the angle of dip in degrees is plotted against distance in feet along the traverse. It is evident that the well-defined peak furnishes an accurate determination of the position of the vein.

Fig. 15 shows two traverses over the ore at drill hole No. 24 taken by means of the self-potential method. The profiles are here flat and fail to indicate the ore. However, in order to show what this method can do over another part of the ore, another profile is shown in Fig. 16. This was taken about 3,000 ft. west in the Edison Kettle hole where the

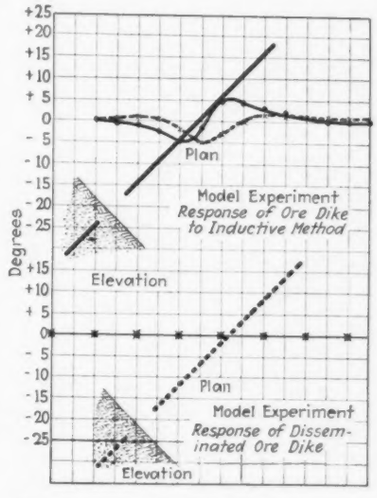

Fig. 11—Curves indicating the response of an ore dike to the inductive method. A model experiment

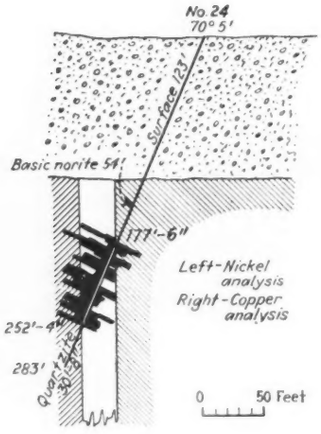

Fig. 12 — Cross-section of drill hole No. 24, according to the Longyear map

cover is 60 ft. thick and the ore 120 ft. thick at its widest part. It is a repetition of S. F. Kelly's traverse No. 5[1]. His curve is shown dotted. It is seen that our curve agrees well, though taken four years later. The negative peak occurs above the ore.

The next illustration figures refer to the surface potential method. Fig. 17 shows four equipotential ovals near drill hole No. 24. The black bars and the arrows refer to a quantitative manner of interpreting the results, which will be described in a subsequent paper. In brief, the theory requires that the ore vein should lie between the four bars given. It is clear that the actual ore is to be found closely central between them.

Fig. 18 shows Mr. Lundberg's well-known extended electrode system as applied at drill hole No. 24. The spreading of the equipotential lines across this vein is evident, and locates its strike and position. The dotted curves are repetitions of the solid ones taken after a heavy rainfall. They agree sufficiently closely with the previous equipotential lines.

The inductive method at drill hole No. 24 was tested at several different frequencies. At 60,000 cycles the curve of Fig. 19 was obtained. These curves represent changes in the strike and dip of the magnetic vector obtained in a straight traverse across the ore. They localize the ore vein within some 50 ft.

The inductive method was also tested at 800 cycles, using a horizontal loop 200 ft. in diameter and situated 1,000 ft. north of the ore. Systematic changes of direction in both the strike and dip of the magnetic vector were obtained in crossing the vein.

Fig. 20 shows another traverse using a small vertical loop source and is of the same nature as the one previously shown in connection with the models over the Edison Kettle hole. The crosses and circles show the distortions in the strike and dip respectively of the incident field as the ore is crossed in a straight line traverse. These results are strictly in accord with expectations and have been confirmed by work with a model of the orebody. In fact, the results obtained with the model are shown by the dotted and solid curves. As in the previous model work, a satisfactory agreement is obtained. This form of the inductive method has proved especially valuable.

I hope this will suffice to show the close and important relation which exists between the three main modes of approach to solutions of the basic exploration problem: the mathematical one; the experimental one, especially through models; and the practical field work. These three means, taken together, are competent to tell us much about the detectability of ores. They are the tools by which we investigate that difficult basic question, "What are the possibilities and limitations of physical methods of ore detection," or "What ores are to be regarded as detectable, and why."

The detectability of orebodies by electrical methods is dependent upon only four factors: (1) electrical conductivity of the ores; (2) continuity of the orebody; (3) size of the orebody; and (4) the distance of the orebody below the surface.

1. Ores which have conductivity sufficiently high for successful prospecting by electrical methods have often been listed. They are the native metals and the sulphides (except sphalerite), the tellurides, arsenides, and antimonides. The non-conductors are the carbonates, silicates, and oxides, except magnetite and some of the oxides of manganese. It will perhaps be well to add that the absence of conductors other than ore is desirable. For example, graphite is a good conductor, and when graphite slates are present results resembling the indications of ore may be obtained. The problem is naturally simplified if it is known that ores are the only conductors present.

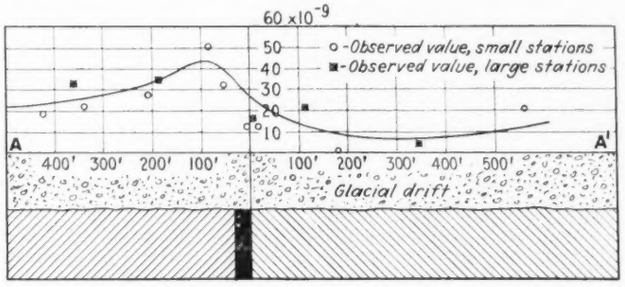

Fig. 13—The transverse component of the gravitational gradient obtained with the Eötvös balance on the Falconbridge orebody

2. The continuity of the mineralized parts of the orebody determines the effective conductivity of the whole mass in as important a way as the conductivity of the pure mineral itself. For it is clear that the orebody cannot constitute a conducting unit unless its mineralized sheets and veins form in the main a connected network. The mechanical nature of the mineral deposit in place is thus a vital consideration, and for this reason the conductivities of small samples of the ore are of less significance than one might think. A misleading conclusion may readily be formed about the actual conductivity of a given type of ore from consideration of its composition only. For example, some deposits containing only a small per cent of sulphides are of such a nature that contact between particles exists, whereas in others containing much greater percentages the rock completely envelops the ore particles, and the mass, as a whole, exhibits only slight conductivity. Disseminated ores may be classed as generally unfavorable, and massive sulphide deposits as favorable, for electrical exploration. Actual measurements of fair average samples of the ore afford more information than tables of conductivity of similar ores. A surer and better criterion will be obtained from underground investigations of neighboring and similar deposits—or, best of all, from actual experiments upon a known neighboring body. It will, of course, often be impossible to obtain the latter type of test.

3. The last two factors of size and depth of burial must be considered together. However, in considering the inductive method, we must at times regard size in a rather novel way. Here the effective volume is not

[1] *Engineering and Mining Journal*, Oct. 7, 1922.

merely that filled with ore, but is more properly that around which the ore forms a complete conducting perimeter. For example, a thin ore vein in the form of a continuous closed loop (should one by chance exist) is nearly as effective as though the ore formed a continuous sheet over the area bounded by this loop. For the inductive method, then, the size of the ore may at times be considered the size of the picture frame, whether or no the picture be present.

Depth Frequently Overstated

4. The depth to which ores may be detected commonly tempts overstatement. We agree with Mr. Lundberg's statement of last May that "The greatest depth to which an orebody may be reached under favorable conditions cannot be generally given." This statement may be somewhat developed. It is a law of electrodynamics that the direction and relative intensities of the electromagnetic quantities are preserved unaltered at corresponding points, when the scale of the geometry is uniformly changed. Therefore, a deep body is theoretically exactly as detectable as a shallow one, *provided* it occurs on the same relative scale. This is illustrated by Fig. 21. Here all the spheres are tangent to the same cone, with apex at the surface, and all are equally detectable at the surface. The law of detectability of ores with respect to distance is an inverse cube law, for the magnetic, gravitational (torsion balance), surface potential, and inductive methods. Some investigators seem to have been misled upon this topic, for two of the active

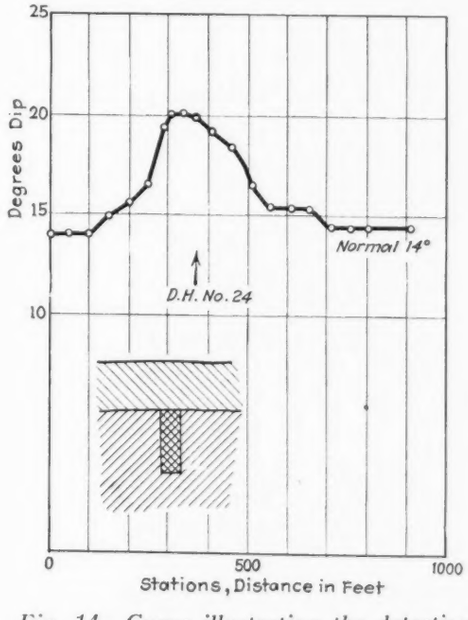

Fig. 14—Curve illustrating the detection of the Falconbridge ore by the magnetic dip needle

operators of electrical methods claim in their descriptive pamphlets that an inverse square law is applicable to their methods.

If you will carefully examine the list of successes with electrical methods you will find the vast majority have been obtained at covers of less than one hundred feet. One can see, by the following example, how slight is the chance of detecting ore at a depth of 500 ft.: Assume a solid pyrite body of a tonnage of 5,000,000. Let it

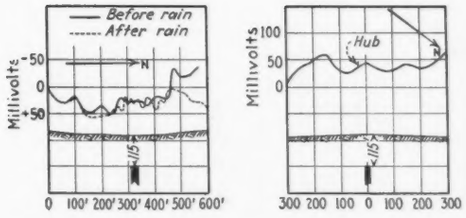

Fig. 15—Results of two traverses over the ore at drill hole No. 24 taken by the self-potential method

be under 500 ft. of cover and roughly of a spherical form. Then the mean diameter of the mass will be nearly 400 ft. Now, if this mass is excited under the most favorable circumstances of a uniform inductive field, its own reaction at the most favorable point at the surface will be less than $2\frac{1}{2}$ per cent of the value of the exciting field. Such a small value will prove very difficult to recognize. It is true that the mass would be more easily found if in the form of a large plane sheet, but my general point still holds: that, for detection, deep bodies must be enormously large. I would, therefore, advise skepticism when working ranges of 500 ft. or more are claimed.

A Practical Rule

From our experience, with theory, models, and practical field work, we should give the following rule: "It will, in general, not be economical to search for massive conducting ores unless two dimensions of the expected orebody approximate the depth of cover." In other words, if the body is lenticular, each of two perpendicular dimensions of the lens should roughly equal the depth of cover. Actual survey conditions are so largely unknown that mathematical refinements in such rules have no place. The statement made will, therefore, serve to give a satisfactory idea of what, in general, constitutes a detectable orebody. As a rougher but simpler rule, which has exceptions under certain conditions, we should advise that physical explorations be confined to regions where the orebodies are expected to approach within 200 ft. of the surface.

Difficulties of Interpreting Results the Great Obstacle

The difficulties in extending the practical limits to which ore may be detected are of a fundamental type. It is not that more sensitive or more accurate receiving

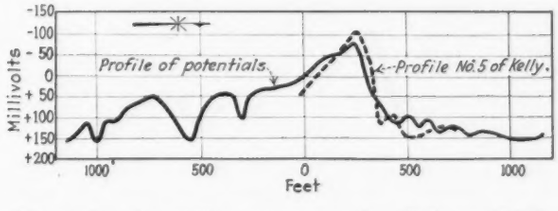

Fig. 16—A profile, taken in the Edison Kettle hole by the self-potential method, compared with that obtained by S. F. Kelly

apparatus is needed, nor that more powerful sources are required. The difficulty arises from the existence of the extraneous efforts of the unknown ground conditions, and is really one of interpreting results. Of course, when

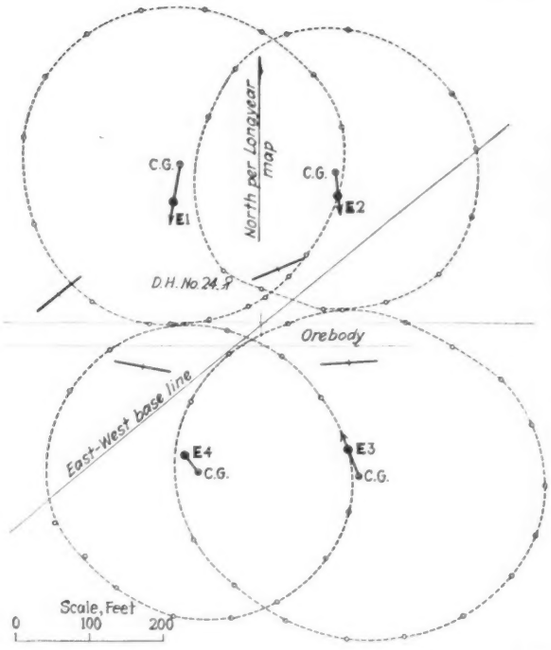

Fig. 17—Equipotential ovals obtained near drill hole No. 24 with self-potential method

the ore is relatively near, it responds in a loud voice, and drowns out all else. When it is further away the inevitable babble of all the other differences begins to become confusing, and finally the small voice of the ore is completely masked by other messages. It will do no good to use a loud speaker, for this will simply increase the static along with the message. The problem is one of selection rather than of sensitivity. In its basic feature it is like the submarine detection problem. There the game was to hear the submarine without hearing your own boat. Here, we must hear the ore without the response from near-by surface conditions. There are, then, natural limits in working range which offer increasing resistance to attempts toward their extension.

Economic Aspects

The business of mining has always involved its own peculiar risks, not found in other branches of commerce and engineering. Evaluation of such risks by intelligent analysis, and the reduction of uncertainties by engineering studies, have helped the industry to proceed along sound lines. The history of the mining business has been the history of the replacement of the "risk all, gain all" attitude of the speculator by policies founded upon the discovery and analysis of facts.

The greatest uncertainties are those met in the exploration of virgin lands for new orebodies. This division of mining is obviously an essential part of the business, and it is important for the industry to eliminate, as far as possible, the gambling aspects of its exploration expenditures, and to put exploration upon as sound a business basis as present circumstances will permit. Not only this, but foresight for the future demands that a fund of data be collected concerning the relation of the newer exploration methods to the possibilities and economics of exploration work. As in all questions in which probability and chance strongly enter, conclusions must be founded on a large fund of experience. It is, therefore, especially important to obtain a statistical view of the results of exploration with the physical methods, and to avoid being misled by success or failure in a few single instances.

The question is, "What is the cost of the failures in physical ore exploration, compared to the value of the successes?" We must be careful to get both sides of the picture. There is a natural tendency in this work to adopt the sun dial's motto, "I count only sunny hours." A satisfactory commercial averaging of both sides of the picture is unfortunately impossible at present. Partly because of the youth of the subject, sufficient data are not available. However, we may profitably discuss some aspects of the commercial side of exploration with physical methods.

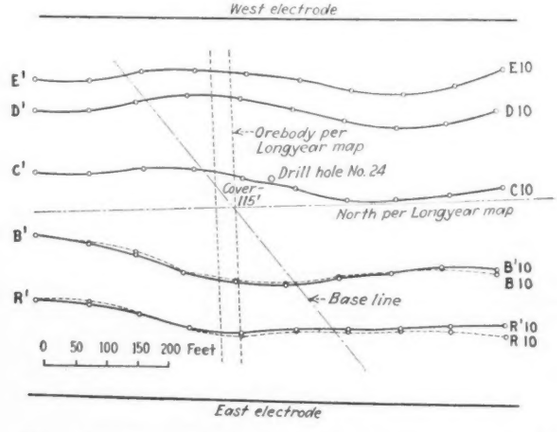

Fig. 18—Results obtained by applying the Lundberg extended electrode method at drill hole No. 24

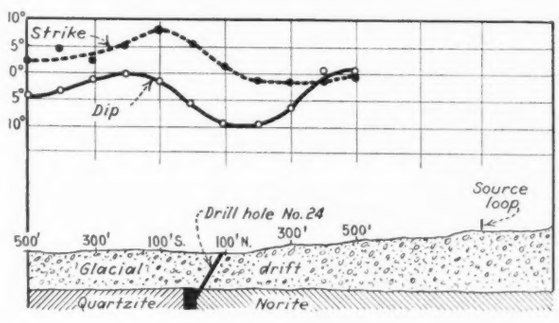

Fig. 19—Curve obtained over the Longyear orebody with the inductive method, using a frequency of 60,000 cycles

The Cost of Prospecting

There is, first, the cost of prospecting with these methods. The costs of exploration are dependent upon the field conditions and location. They may be analyzed in several parts:

1. The cost of transporting the party and equipment to the field location. This is variable, of course, but in a survey of a month or more it is usually relatively small.

2. The cost of maintaining camp, including commissary.

3. The cost of the transit survey, the clearing of brush, and the staking out of stations on traverses. This item will be fairly large in difficult, brush-covered country. To keep ahead of the field party we have had to maintain at times three axe crews of four men each,

which cut through about 15,000 ft. of traverse per day. In the region near Sudbury, Ont., transit costs have averaged, in over 100 miles of traverse, about $25 to $35 per mile, including all costs for brush cutting.

4. The other costs are those directly involved in taking the data of the physical survey. In our usual type of exploration, they are divided between the inductive, the terrestrial-magnetic, and the self-potential methods, about as the ratios of 4 to 1 to 1. The inductive method is naturally the more elaborate and expensive.

In one survey of 22 working days near Sudbury, Ont.,

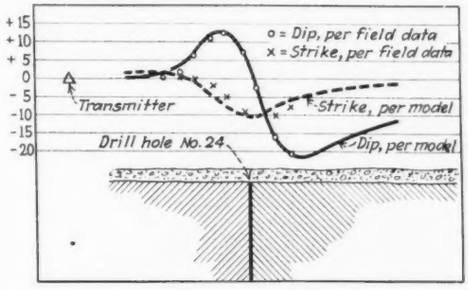

Fig. 20—Results obtained with the inductive method over the Longyear orebody compared with those obtained from a model

the total field costs for the self-potential, magnetic and inductive methods, apart from travel and shipping expenses, were under $5 per acre.

In this survey, the traverses were separated 500 ft. except where mineralization was discovered. In the most interesting areas, a separation of only 200 ft. was used, and ten additional cross traverses were run.

The total over-all cost of about $5 per acre is roughly typical of the area, although we have completed similar surveys in the same region totaling 4,000 acres, under somewhat more favorable topographic conditions, at the rate of just over $4 per acre.

At present, we would put the total cost for a three-method survey of the above type, at from $5 to $7.50 per acre. These figures, of course, apply only to surveys of several square miles. In smaller ones, the fixed charges bring up the cost per acre.

No Physical Method Detects Ore

In considering exploration costs, a general fact should be borne in mind, which is sometimes neglected by enthusiasts: No physical method detects ore, but only some physical characteristics, usually, but not *exclusively,* associated with ore. There are conducting ores, but also conducting graphitic slates. There are heavy ores, but also heavy rock formations. There are ores showing chemical activity, and a resulting earth current, but many other ground conditions lead to current flows. No method can positively discover ore. By using several methods, it is sometimes possible to obtain independent confirmations of indications, but not absolute certainty.

Because of these facts, a certain percentage of failures must be expected, and this percentage will be dependent upon the intelligence, knowledge, and experience of the exploration group. As yet no adequate fund of data is available to show what percentage of success, under given operating conditions, will be attained. We ourselves have done research exclusively until last year and have thus far made practical surveys of only nine different mineral regions. Four of these were over known ore, used by us for experimentation. In each of these four cases our results agreed with ore known to exist. Of the remaining five areas, only one has thus far been drilled. Here a mineralized fault was discovered in the position indicated by us, with commercial ore in spots. It is not yet known whether a sufficient quality exists for a mine. One of the other locations was trenched, with the resulting discovery of non-commercial sulphides near the surface. In the course of time experience will permit a clear statistical representation of the probabilities of success in physical prospecting and of the degree of the risk involved. It will, however, be impossible to predict the composition, or type, of the suspected orebody, and the drill and underground work must be considered as indispensable as ever. Physical prospecting, like geology, can simply indicate favorable positions for drill holes.

Underground Exploration an Attractive Field

It is obvious that returns from investments in physical prospecting will be highly dependent upon the success in choosing areas favorable for their use. Because of this fact, we believe underground explorations in producing mines will be an attractive field for future applications of physics. Since it is a well-known fact that about nine-tenths of all new discoveries of ores are near existing mines, one can feel sure that such areas are highly favorable for electrical prospecting. Furthermore, operations underground are likely to be much nearer the ore, hence the limitations of range are not so serious. In many instances, it would be most valuable to determine whether ore exists within a radius of 100 ft. of certain drifts and crosscuts.

The progress which the future will bring should be continuous and gratifying, but it will not be spectacular in the sense that any glorified witch-hazel wands will be discovered. Improved technique and increased knowledge will be attained through the same process of intelligent and energetic research to which all the important applications of physical science owe their birth. Although physical exploration for ores is a scientific development which can claim only a short history, its economic value has already been demonstrated in many areas. The present accomplishments and technique in this field warrant serious consideration by mining men in laying any sound policy and program of ore prospecting. When conservatively and intelligently applied, in regions suited to their nature, I believe that physical prospecting methods will amply repay investments.

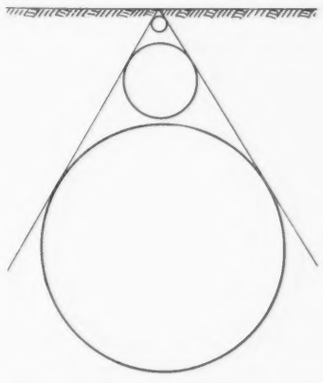

Fig. 21—These spheres are all equally detectable at the surface

(Comment on Dr. Mason's paper appears on following page)

Erratum. The caption of Fig. 4, on page 767 of Part I of Dr. Mason's paper, in the issue of Nov. 12, should read "surface-potential" and not "self-potential."

When Dr. Mason had concluded the presentation of his paper at the Machinery Club, a member, Mr. Parks, arose and inquired whether any work had been done on detection by radio-activity. The speaker said that, like Dr. Mason, he had been engaged during the war in the detection of submarines, but that he had been working in rather a different direction from that of detection by sound. He had been using a method based upon electrolytic action and said that he had found it possible to detect the immersion of metals in saline solutions such as sea water at very considerable distances. The method offered great possibilities, the speaker said; and in connection with orebodies it might possibly be used.

"You had reference to the currents which occur between the upper portions of oxidized orebodies and the unoxidized portions below, and it might be possible to my mind to develop methods along that line for detecting the electrical energy which is passing out, or actually detecting the radio energy which comes from certain classes of minerals which we know, as in the case of uranium," said Mr. Parks.

Cross-Checking Makes Results More Certain

Dr. von Buelow-Trummer, vice-president of North American Exploration Co., Inc., said: "I followed Dr. Mason's talk closely and with greatest interest, due especially to the fact that we ourselves are working with all possible geophysical methods: the torsion balance, the magnetometer, seismic and electric methods.

"I fully agree that the average depths generally reached by electric measurements can be given from about 400 to 500 ft. At one place, however, we were fortunate enough to follow up a known orebody buried 650 to 700 ft. below very bad surface, but this orebody was of large dimensions and this was exceptional.

"What we obtain by any geophysical measurements are 'indications' which on mining properties might come from an orebody, or might not. Therefore we very often like to cross-check one measurement with another entirely different, for instance electric with magnetic. This, with good geological knowledge and a careful interpretation of the measurements, will make the results more certain.

"Drilling will have to be done on places indicated by geophysical measurements to prove whether the indications are due to ore. Drilling without geophysical measurements is like shooting into the dark."

Electrical Surveying Has Its Limits

E. H. Guilford, representing the Radiore Company, said that his company was making electrical surveys of mining properties for the purpose of locating sulphide orebodies. The basis of their process, he said, was the inductive method, in the application of which, radio-frequency currents were employed and a vertical loop was used to create the primary fields. "At present," said Mr. Guilford, "the Radiore Company has five crews in Canada on different properties. Their services are contracted for through February, 1928. The company has been actively engaged in electrical surveying in Canada since June, 1927, and has been in the electrical surveying business for the last three years. Up to the present, in Canada, four distinct bodies of sulphide ores located by means of the Radiore process, not hitherto known or explored, have been proven by means of a diamond drill. In addition, seven distinct orebodies located by means of the same process, and not hitherto known and explored, have been proven by means of trenching. Up to the present all attempts to prove indications have succeeded.

"I agree with Dr. Mason that it is necessary to conduct a campaign of education with our customers, teaching them the limitations as well as the possibilities of electrical surveying" continued Mr. Guilford. "We have found in Canada that some customers, due to the lack of thorough understanding, are prone to overstate the results of an electrical survey on their property, some going so far as to state that 'the Radiore process has located large bodies of high-grade ore.' We have counteracted such statements by including in all of our advertising the cautionary line 'No electrical prospecting method will determine the character or the value of a mineralized area.'

"While an electrical prospecting method is essentially a means of locating the electro-conductive areas of a property, we have found that no conductive areas except sulphide bodies have been located, probably due to the fact that, in practice, the Radiore process will not give conclusive indications of a conductor unless the ratio of conductivity between the sulphide body and the surrounding medium is very high, in the order of 1000: 1."

Mr. Lundberg, of the Swedish-American Prospecting Corporation, said that they found that in the ground conditions were certainly more complicated than they ever could have imagined before starting. In fact, the ground itself was sometimes a good conductor, especially in sedimentary regions. This would sometimes prevent the possibility of finding ore in such regions. They had found that it was necessary to investigate not only all data of the ore itself but of the rock and of the rock in different places of the area, the water conditions and the conductivity and electrical conditions of the water. Furthermore, it was necessary to investigate the petrographic conditions, the arrangement of the minerals, the arrangement of the conducting minerals as well as the arrangement of the non-conducting minerals. By doing so it seemed possible to elaborate methods by means of which it would be possible to choose or pick out certain indications as being due to more homogeneous sulphides.

Experience a Factor in Interpretation

E. G. Leonardon, manager of the Schlumberger Electrical Prospecting Methods, answering a question, said that some experimentation had been done on coal by the Schlumberger methods. Anthracites were generally good conductors of electricity and consequently must develop strong spontaneous electrical current. On the contrary, the bituminous coals were generally not conductive, Mr. Leonardon said. This property could sometimes be used for electrical studies; for instance, by sending the electrical current under the coal measures through a drill hole and studying the distribution of the potentials on the surface. Such a problem, of course, was quite different from the exploration for ore. In a more general way, it was the application of electrical exploration to stratigraphical studies.

Mr. Leonardon agreed with Dr. Mason that in electrical prospecting an important factor was experience, which permitted a good interpretation of results obtained; also that while many customers were rather skeptical, some were too enthusiastic. They announced the presence of orebodies long before they were proved, said Mr. Leonardon, and this was why many discoveries were credited to electrical exploration which are not confirmed by subsequent work. Every engineer knew that important discoveries were, of necessity, not numerous. Furthermore, it often took a long time to prove an orebody, the speaker said, citing several instances.

Comparing Efficiencies of Centrifugal Pumps

Sizes of Suction and Discharge Nozzles, and Piping Arrangement, Must Be Considered

By GEORGE H. GIBSON
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THE EFFICIENCY of a machine which has for its purpose the transfer or transformation of energy is ordinarily defined as the ratio of the energy output to the energy input. The energy input of a centrifugal pump is the energy applied to turning the shaft, whereas the energy output is calculated as the volume of fluid handled multiplied by the increase in pressure generated, or as the weight of fluid multiplied by the head pumped against. However, the total mechanical energy of a fluid includes pressure head, elevation head, and velocity head, all of which items must be taken into account.

The gain in pressure is readily measured by pressure gages connected to the inlet and outlet nozzles, respectively. Any difference between the elevations of the pressure-responsive parts of the two gages must be taken into account as elevation head. This is easily measured, or can be eliminated from the calculation by placing the two gages at the same level. The remaining item, velocity head, is sometimes overlooked and sometimes misunderstood by the pump user, and is the subject of the present discussion.

Velocity head is the vertical distance in which a freely falling body would gain the velocity being considered, and is equal numerically to the velocity in feet per second squared, divided by twice the acceleration of gravity in feet per second per second, or in algebraical symbols, $\frac{V^2}{2g}$. The velocity of the fluid as it enters the suction nozzle or leaves the discharge nozzle of a centrifugal pump is readily calculated by dividing the flow in cubic feet per second by the cross-sectional flow area in square feet. If the areas of the suction and discharge nozzles are equal, there is no correction for velocity head, but if one is larger than the other, the difference in velocity head is added to, or subtracted from, the pressure head developed by the pump, accordingly as the discharge nozzle is smaller or larger, respectively, than the suction nozzle. The rule given in the "Standards of the Hydraulic Society" reads:

> "If the discharge pipe is of smaller diameter than the suction pipe, which is often the case, then it will be necessary to add to the total head, as shown by the gages, the difference in velocity head between that of the discharge and that of the suction pipe at the points where gages are connected. If the discharge pipe is larger than the suction pipe, the difference in velocity head must be subtracted from the total head."

From the point of view of energy transferred to the water in the pump, the theory of this rule is entirely correct, but it can lead to considerable error in evaluating the practical utility of a pump. The piping connections should also be considered, as will appear from the following example:

Suppose bids are asked on a pump of 18 in. nominal size to deliver 9,000 gal. per minute against a 35-ft. head, and that one manufacturer, figuring on a pump with an 18-in. suction nozzle and an 18-in. discharge nozzle, guarantees 82 per cent efficiency, whereas another manufacturer, offering a pump having an 18-in. suction nozzle and a 16-in. discharge nozzle, guarantees 82.5 per cent efficiency. Which is the better pump, other things being equal? It is assumed that on test each pump will show exactly the efficiency guaranteed. The pump credited with the higher efficiency, however, gets credit for its efficiency by virtue of a velocity head correction of $\frac{(14.4)^2}{(64.4)} - \frac{(11.4)^2}{(64.4)} = 1.2$ ft., 11.4 ft. per second being the velocity in the suction nozzle and 14.4 ft. per second the velocity in the discharge nozzle, and the question therefore is, does the customer receive the full benefit of this velocity head?

If there is space enough to install a straight 16x18-in. increaser, from 60 to 70 per cent of the velocity of the water as it leaves the pump may be converted into useful pressure head. It will not in general do to have the entire discharge piping of 16 in. diameter, as that would lead to excessive pipe friction; in fact, in practically all installations it should be larger than 18 in. Thirty per cent of 1.2 ft. is 0.36 ft., so that there will still be a net loss of about 1 per cent of the total head, and the over-all efficiency will be 99 per cent of 82.5, or only 81.67 per cent, compared with the 82 per cent guaranteed for the pump having the 18-in. discharge nozzle.

In probably ninety-five cases out of a hundred, moreover, the pump will be installed with the discharge flange bolted directly to an elbow to connect with a pipe extending vertically upward to the ceiling or downward through the floor. The friction of a 90-deg. ell is commonly figured as equal to that of 50 ft. of straight pipe, on which basis the pump with the 18-in. discharge nozzle will have a loss through the elbow of 1.63 ft., whereas the pump with the 16-in. discharge nozzle will have a loss through the elbow of 2.85 ft. The loss with a 16x18-in. increasing ell would be almost as great, because practically no conversion of velocity to pressure would occur in the elbow. There is accordingly an increased loss, caused by the use of the 16-in. discharge nozzle, of $2.85 - 1.63 = 1.22$ ft., or 3.48 per cent of the total head developed. Based upon readings taken at the outlet of the ell, the

pump having the 18-in. discharge nozzle has a useful efficiency of $\frac{35 - 1.63}{35} \times 0.82 = 78$ per cent, whereas the pump with the 16-in. discharge nozzle has a useful efficiency of only $\frac{35 - 2.85}{35} \times 82.5 = 75.7$ per cent.

The customer similarly pays an excessive price for a small discharge nozzle when a check valve is bolted directly to the pump flange, as is frequently done. At high velocities, friction losses through check valves are considerable. The friction through a 16-in. valve at 14.4 ft. per second velocity may, depending upon design, be as much as 6.1 ft., and through an 18-in. valve at 11.4 ft. per second velocity, 3.8 ft., or an additional loss through the 16-in. valve of 6.1 — 3.8 = 2.3 ft. Therefore, based upon the head remaining at the discharge from the check valve, the 18-in. discharge nozzle pump will show an efficiency of $\frac{35 - 3.8}{35} \times 0.82 = 73.1$ per cent, whereas the 16-in. discharge nozzle pump will show $\frac{35 - 6.1}{35} \times 82.5 = 68.2$ per cent, or about 7 per cent lower useful output than the 18-in. discharge nozzle pump.

In other words, the customer should consider the complete installation, including the piping arrangement which will be used with the pump, when comparing efficiencies, and he should bear in mind that a pump having the proper size of nozzle may give a greater useful effect, even though its guaranteed efficiency is lower. This applies particularly to low-head pumps, where the velocity head constitutes an appreciable part of the total head.

As the velocity in the pump volute is always much higher than in the discharge nozzle, one of the problems of the pump designer is to convert this high velocity into pressure as efficiently as possible, but it is easier for him to leave the velocity high, clear up to the discharge nozzle, especially if he can persuade the user to give him credit for the entire gain in velocity head between suction and discharge nozzles. The better showing made by the pump having a small discharge nozzle will be more than offset by loss in the piping unless an efficient straight increaser is put in between the pump discharge flange and the pipe line. Unless this could be done, the pump with the 18-in. discharge nozzle in the above example would be much preferable to the pump with the 16-in. discharge nozzle. In any event, a pump which has a discharge nozzle smaller than the suction nozzle should not be given full credit for velocity head in comparing it with a pump having both nozzles of the same size, because it is impossible to convert 100 per cent of the velocity into pressure, even with the best piping layout. In most installations, as a matter of fact, no effort is made to obtain efficient conversion of velocity head into pressure.

Lubrication of Wire Rope Important

The matter of friction between the strands of a wire rope is essentially the same as friction between a bearing and shaft, says *Lubrication*. Overheating and abnormal wear will practically always result, and reduce the load carrying capacity and increase the amount of power consumed in operation. This can only be overcome by the application of a wire-rope compound, which will be sufficiently adhesive and viscous to resist being prematurely squeezed out or washed off by rain or melting snow.

Determining MgO Quickly

By Samuel G. Lasky
Mining Engineer, Kennecott, Alaska

In a dolomitic limestone country where mineralization is either confined to or is more intense in certain horizons, a geologist may find it desirable to have information as to the MgO content of the limestone for use in planning exploration work. The fracture, so often crystalline, of high dolomitic limestones, together with their glisten, makes it easy to distinguish them with the naked eye from the true limestone, with its conchoidal fracture and dull luster. On extended acquaintance, one may even make a close approximation of the amount of MgO present, from the appearance of the rock. An intermediate grade of dolomite occurs, however, containing from 4 to 8 per cent MgO and in this material visual distinction becomes difficult: it exhibits a glisten and a fracture that are confusing. Also, some true limestones present a coarsely crystalline appearance which one may mistake for a dolomitic rock.

A correct MgO analysis requires about twenty-four hours—an overnight quiescence for full precipitation of the magnesium ammonium phosphate. Consequently, anyone wishing an analysis and anxious for the information it may give should hesitate to present too many samples to a busy routine assayer; and a short method whereby one may determine the assay within desirable limits should be of helpful interest.

To give me this information when and as wanted I have used the following method for determining MgO analysis. I have found it accurate to less than 1 per cent on rock running 15 per cent or over, and to less than 0.5 per cent on rock running about 5 per cent. The time required is only about an hour and a quarter, and this may easily be cut to less than an hour if care is taken to keep the bulk of the solution low. Full attendance during this time is not required; the analyst may attend to something else during evaporation and ignition of the residue.

Dissolve 1 gram of the sample in dilute HCl. Without filtering off any insoluble material, make strongly ammoniacal and add two or three drops of $(NH_4)_2S$ or its equivalent to precipitate any metallic sulphides. Heat to boiling and add enough $(NH_4)_2C_2O_4$ to bring down all the calcium. Filter, evaporate the filtrate, which should contain all the magnesium, to dryness and ignite in the muffle for about fifteen minutes. Weigh the residue as MgO, 1 mg. equaling 0.1 per cent. It is unnecessary that the $(NH_4)_2C_2O_4$ be added in solution; the amount of magnesium mechanically entrained with the calcium is negligible in so far as it influences accuracy in this special operation. It does hasten work, however (which is the main reason for developing the method), to make and use a stock solution of such strength that the addition of about 20 c.c. will precipitate the maximum possible quantity of calcium present. All of the magnesium does not ignite to MgO, but there seems to be a constant of error which takes care of this and gives results within the limits mentioned.

A volumetric method was also tried in which the MgO is determined by difference through titrating for CaO and for total alkalinity in terms of CaO. The difference of the two, multiplied by the proper factor, 0.718, equals the MgO. This method is very short; but where the rock contains high percentages of MgO it gives results that are too high.

Reducing Silver Sulphide Obtained by Cyanidation

Its Application in the Cyanide Field

By G. Newton Kirsebom
Metallurgist, New York City

In precipitating silver from cyanide solutions by present methods, the precipitating agent is not recovered. Where zinc dust or aluminum are used they are definitely lost and by gradual precipitation in the slime are automatically prevented from accumulating in the mill solution. Where sodium sulphide is used for precipitation, as in the Cobalt district, free cyanide is re-formed in the solution according to the reaction: $2NaAg(CN)_2 + Na_2S = Ag2S + 4NaCN$. This method of precipitation is applicable to solutions which do not carry gold, more especially when large amounts of base-metal cyanides are present, as neither gold nor base metal is thus precipitated from solutions carrying excess sodium cyanide. In the Cobalt district a very pure silver sulphide thus recovered is worked up to metallic silver by reduction with aluminum powder in a caustic soda solution. A sludge of metallic silver is thus obtained, which is then filtered off, the filtrate being discarded as being unsuitable for re-use in the process. This involves a consumption of certain amounts of sodium sulphide, metallic aluminum, and caustic soda. Generally, the consumption per 1,000 oz. of refined silver is 40 lb. of commercial sodium sulphide, 6 lb. of aluminum and 45 lb. of caustic soda.

Effect of Fused Caustic Soda on Silver Sulphide

In the process to be discussed in this article, use is made of a certain reaction between caustic soda and silver sulphide which careful laboratory experiments have shown to be as follows: $3Ag_2S + 6NaOH = 3Ag_2 + 2Na_2S + Na_2SO_3 + 3H_2O$. In the first tests carried out with this reaction, artificially prepared silver sulphide was melted down in an iron crucible with an excess of caustic soda at a temperature of about 350 deg. C. The black color of silver sulphide disappeared quickly and a spongy mass of metallic silver formed in the crucible. After about ten minutes' reaction, the melt was discharged onto a disk and leached with water, the sponge silver was filtered off, and the resulting solution evaporated. At a certain stage in the evaporation a white salt separated, which, on analysis, proved to be anhydrous sodium sulphite; the remaining solution was evaporated to dryness and was found to be a mixture of sodium sulphide and free caustic soda. These experiments were now repeated, using a carefully weighed amount of silver sulphide and a slight excess of caustic soda, which had been analyzed previously. Table I gives the results. The rapidity with which the reaction took place seemed to indicate that it was exothermic, and heat seemed to be evolved during the reaction, as might be expected from the theoretical heats of combination:

$$3Ag_2S + 6NaOH = 3Ag_2 + 2Na_2S + Na_2SO_3 + 3H_2O$$
$$3 \times 3{,}000 + 6 \times 102{,}700 \qquad 2 \times 89{,}300 + 305{,}460 + 3 \times 58{,}060$$

or + 33,040 calories.

After this had been determined, the line of attack would naturally be to try to promote the reaction with the smallest possible amount of heat. A series of tests were made in which the caustic soda was mixed with the theoretical proportions of silver sulphide in an iron crucible and heated at various temperatures over a Bunsen burner. The reaction was then found to start slightly above the boiling point of water and to proceed very quickly at a temperature of 200 deg. C., that is to say, considerably below the melting point of caustic soda, which is 318 deg. C. The black sulphide disappeared completely, to give place to a network of metallic silver needles. On leaching the mass with water, the sodium salts were entirely removed, leaving a rather coherent mass of metallic silver which could be hammered into one piece.

A third series of tests was made in which the endeavor was to effect the reduction of the sulphide and the smelting of the silver in one step. In this work the reduction was carried out in a Dixon graphite crucible brought to a high temperature in a gas furnace. The silver was thus completely recovered, but some of the slag was absorbed by the crucible, giving an incomplete recovery of the sodium sulphide.

In the fourth and last series of tests galena was introduced with the mixture. This is for the reason that lead sulphide, in common with silver sulphide, is reduced by caustic soda to the metal: $3PbS + 6NaOH = 3Pb + 2Na_2S + Na_2SO_3 + 3H_2O$. This reaction is slightly endothermic and will proceed only when the caustic is melted, or above 318 deg. C. The object, however, in adding the galena was to obtain a molten metal in the form of a silver button. This button could then be parted by cupellation and the lead of the galena recovered as litharge in an inexpensive way. Besides, the galena would provide the excess sodium sulphide required to keep up the cycle. If the silver be precipitated with sodium sulphide from the mill solution and the resulting silver sulphide be treated with caustic soda, only two-thirds of the sulphur will be available for re-use, the other third being lost as sodium sulphite. By using galena in

Table I—Results of Test with Artificially Prepared Silver Sulphide

Test No.	Time in Minutes	Temp., Deg. C.	Materials Used Grams		Products Obtained, Grams				
			Ag_2S(a)	NaOH(b)	Ag	Na_2S	$NaSO_3$	H_2O	Residue
Theoretical	..	...	7.44	2.40	6.48	1.56	1.26	0.54	.....
Nr. 1	15	350	7.44	2.40	6.38	1.48	1.24	....	0.30(c)
Nr. 2	15	350	7.44	2.64	6.46	1.50	1.25	....	.....

(a) Eimer & Amend silver sulphide contained some moisture, which was previously determined.
(b) 96.2 per cent NaOH was used the weights given being for pure material.
(c) Unchanged sulphide.

the fusion this additional sodium sulphide is supplied. This will be an advantage, as 96 per cent sodium hydroxide can be obtained for the same price as commercial 60 per cent sodium sulphide.

In applying this method in connection with cyanide work it is apparent that it would seem the more attractive at works where sodium sulphide precipitation is already in practice. The silver sulphide could be treated with caustic soda to produce metallic silver and sodium salts of which two-thirds would be present as sulphide, which would then be available for re-use. Overtures were accordingly made to a company using sulphide precipitation, which resulted in their metallurgists' undertaking to carry out a series of tests to find out the value of the new process compared with the one in use. The results of these tests are shown in Table II.

As will be seen from these tests, only one alternative was tried, in which the reduction was carried out at high temperatures so as to obtain the silver as bullion at once. This resulted in a high heat expenditure, which was given by the company as the main objection to the process. This can be seen from the comparative cost figures in this column.

If the fuel cost be disregarded, there is only a material cost of $1.32 against $4.77 in the old process. This fuel cost would not have been of importance if one of the two other alternatives had been tried; either by fusing at 200 deg. C. with subsequent leaching and smelting down of the metallic silver in the ordinary way or by mixing with galena and smelting at 350 deg. C. followed by a cupellation of the lead. In both these methods the heat expenditure would not much exceed that of the old process and a saving of materials amounting to about $3.50 per 1,000 oz. of refined silver would actually result.

Comparison of costs of materials per 1,000 oz. silver.

Present process in use:

	Theoretical	Actual
40 lb. 60% Na_2S @ 4.26c.	$1.72	$1.85
6 lb. aluminum @ 26.01c.	1.56	1.49
45 lb. 76% NaOH @ 3.975c.	1.79	1.43
9.25 gal. fuel oil @ 14.13c.	1.31	1.31
Total.	$6.38	$6.08

Caustic soda process

33.5 lb. 76% NaOH @ 3.975c.	$1.32
38.25 gal. fuel oil @ 14.13c.	5.40
Total	$6.72

With improvements in zinc-dust precipitation such as the Crowe vacuum treatment, which actually makes possible a consumption of only half a pound of zinc dust per pound of silver in many instances, it seems unlikely that the advantages to be obtained by the introduction of this new process would be great enough to warrant the considerable change in equipment which would be necessary. It is in those fields where the present methods of cyanidation and zinc-dust precipitation have proved inadequate that the new reduction method has a possibility of attaining some degree of importance and it is in such fields that present investigations are being conducted.

The treatment of cupriferous silver-gold ores by cyanidation is difficult owing to the large amounts of cyanide absorbed by the copper, from which it cannot again be recovered without considerable expense. It is only in recent years, with the experience gained in the recovery of cyanide from waste solutions, that some possibilities have presented themselves of coping with this difficulty. In the neutralization of these solutions with sulphur dioxide gas as used in both the Halvorsen process at Tonopah and the Merrill Company's recovery processes in Mexico, the following points have been noted:

1. The hydrocyanic acid formed by neutralizing a cyanide solution with sulphur dioxide gas will stay dissolved in the solution at ordinary temperatures and pressure so long as no carrier current of gas or air is provided.

2. If sodium sulphide be present in the solution during this neutralization, copper and other base metals will be precipitated as sulphides.

In other words, if desired, it is possible by neutralization of the mill solution to free it of its copper content in the presence of sodium sulphide without loss of cyanide, and the neutralized solution may, after filtration of the copper sulphide, again be causticized and returned to the mill. It is evident that to carry out such a process in places where zinc dust or aluminum is used for precipitation would lead to complications. In the first instance, the zinc present in the solution would also be precipitated as sulphide, making the sodium sulphide consumption excessive and recovering a mixed copper and zinc sulphide not attractive to a smelter. If aluminum were used, a slimy aluminum hydroxide would be precipitated with the copper sulphide, which would make filtration difficult, and the precipitate would also retain large amounts of cyanide mechanically owing to the absorbing quality of aluminum hydroxide. On the other hand, where sulphide precipitation of the silver is used, these objections are of no importance, and by com-

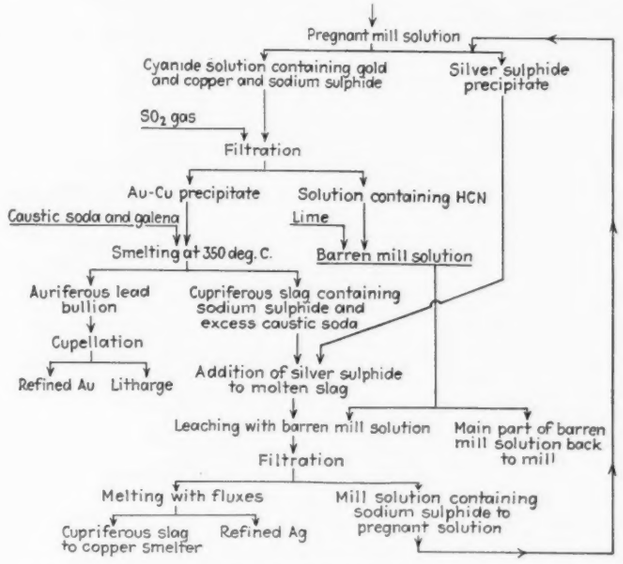
Table II—Tests on Reduction of Silver Sulphide with Caustic Soda at a Cyanide Mill

In the following tests the precipitate used was from the low-grade plant. It is assayed 23,726 oz. per ton and contained 48.2% moisture (cyanide solution).

Test No.	Weight of Wet Precipitate	Silver Content	Weight of NaOH	Time Required to Melt Charge	Total Time of Fusion	Bullion Fineness	Remarks
A	163 lb.	1000 oz.	35 lb.	4 hr.	4¼ hr.	986	Melted in graphite crucible in tilting furnace. Slag was skimmed off before pouring bullion.
1	74 gm.	1 oz.	28 gm.	13 min.	28 min.	994.0	Melted in Battersea crucible in small muffle furnace. Excess caustic soda used (90-95% NaOH).
2	74 gm.	1 oz.	28 gm.	13 min.	1 hr. 13 min.	983.8	.....
3	74 gm.	1 oz.	28 gm.	13 min.	3 hr. 13 min.	980.8	.....
4	74 gm.	1 oz.	14 min.	10 min.	10 min.	991.1	Slight excess NaOH
5	74 gm.	1 oz.	14 gm.	10 min.	16 min.	989.6	.....
6	74 gm.	1 oz.	14 gm.	10 min.	25 min.	989.6	.....
7	148 gm.	2 oz.	28 gm.	10 min.	25 min.	993.6	.....
8	163 lb.	1000 oz.	35 lb.	5½ hr.	6 hr.	986.6	(76% NaOH).
				2 hr.	5 hr.	989.8	Bullion re-melted in open crucible. Charge was skimmed during this period.

bining such a method with the caustic reduction process for silver sulphide, a method of procedure may be developed which may show how to cyanide cupriferous silver ores efficiently.

In the accompanying flow sheet is shown the procedure as it could be worked out where the solution contains considerable amounts of copper besides silver and gold. The mill solution is treated first with some barren cyanide solution containing sodium sulphide, and the silver sulphide is precipitated, leaving in solution gold and copper. After filtration of the silver sulphide, the solution is



Suggested flow sheet for treatment of solutions high in copper

treated with sulphur dioxide gas until the neutralization point is reached, when the sulphide of copper and the sulphide or cyanide of gold will precipitate. These sulphides are now filtered off, and the barren solution is treated with lime and returned to the cycle for new extraction. The precipitate of gold and copper sulphide is now smelted with a mixture of caustic soda and galena. Enough galena is added here to make up for the losses of sodium sulphide in the cycle, and enough caustic to reduce the gold and lead and subsequently the silver sulphide. A gold-lead button is thus obtained which is cupelled, producing refined gold and litharge. The molten slag, consisting of unchanged copper sulphide besides sodium sulphite and excess caustic soda, is now poured over freshly precipitated silver sulphide. The reduction to metallic silver takes place at once, and the fused mass may now be leached with barren mill solution. After filtration, the solution is returned for precipitating new amounts of mill solution and the precipitate is smelted with borax or silicate fluxes. A refined silver is thus produced, besides a copper slag which may be sold to copper smelters.

The following figures will give a picture of how this process would look from an economic standpoint: $6Ag_2S + 12NaOH = 12Ag + 4Na_2S + 2Na_2SO_3 + 6H_2O$.

To supply enough sulphur for the sulphide lost in this operation lead sulphide must be added according to the formula: $3PbS + 6NaOH = 3Pb + 2Na_2S + Na_2SO_3 + 3H_2O$. According to this, 18 NaOH will theoretically have to be used for 12Ag, or 39 lb. NaOH per 1,000 oz. Ag. Assuming 96 per cent NaOH and a mechanical loss of 50 per cent, the consumption of caustic soda would be about 60 lb. If galena carrying 90 per cent PbS be used, the necessary amount of this material would be 44 lb., corresponding to a production of 37 lb. litharge per 1,000 oz. of silver.

For each 1,000 oz. of silver, sodium cyanide would have to be neutralized with sulphur dioxide gas, calling for a consumption of 11 lb. of sulphur. Adding to this, 200 per cent for free cyanide in the solution and another 200 per cent for protective alkali, would give in all a consumption of 55 lb. of sulphur per 1,000 oz. Ag. Disregarding the copper present in the solution, the material cost would then be:

Per 1,000 oz. Ag:	
60 lb. 96% NaOH @ 4c.	$2.40
55 lb. sulphur @ 2c.	1.10
Total	$3.50

Figuring now separately on the copper present in the solution, the following is evolved:

$$Na_2Cu_2(CN)_4 + 4H_2SO_3 + Na_2S = Cu_2S + 4NaHSO_3 + 4HCN$$

Theoretically, for each 126 lb. of copper present, 128 lb. of sulphur would be used, besides 78 lb. of sodium sulphide. If this latter is produced from lead sulphide, 125 lb. 96 per cent NaOH would be required, or:

125 lb. NaOH @ 4c.	$5.00
128 lb. sulphur @ 2c.	2.56
Total	$7.56

The copper would have a value in the slag of 60 per cent of the market price of refined copper, or with copper at 13c., 126 lb. copper at 7.8c. totals $9.83.

In other words, the copper would pay for the sulphur and the caustic soda used in the operation for recovering this metal. With a total release of the corresponding cyanide this should correspond to 196 lb. NaCN, which, at 15c., amounts to $29.40.

The precipitation of the gold, either as simple cyanide or sulphide, through neutralization of the solution in the presence of sodium sulphide, does not occur completely where gold alone is present. However, in the presence of an excess of base metals such as copper, the precipitation occurs to such an extent as to leave only a small amount of the gold circulating in the mill solution. Experience in the cyanide field indicates that this will not lower the extraction of the gold. If other base metals be present in the solution, such as nickel, cobalt, or zinc, these will precipitate with the copper, releasing the corresponding amount of cyanide. There is also reason to believe that the separate precipitation of the silver and gold will be so complete as to save the expense of a subsequent parting of the metals.

Alluvial Diamond Output High in 1926

The most important circumstance affecting the diamond market for a long time past has been the uncontrolled situation at the alluvial diggings, says the Johannesburg correspondent of the London *Economist*. In 1926 the alluvial output was 808,329 carats, valued at £3,983,681, compared with 239,257 carats, valued at £1,906,618, in 1925. In 1926 the diamond mines produced 2,409,637 carats, valued at £6,699,916, against 2,190,871 carats, valued at £6,291,510, in 1925.

DISCUSSION

For Revising the Mining Law

THE EDITOR:

Sir—I have been following with much interest the discussion of our mining laws as they relate to the location and working of our mineral deposits, and especially as to extralateral rights, but I have not noticed that anyone has suggested a substitute that did not add objectionable features which more than outweighed the benefits. I have made many mineral locations. When doing so, it always seemed like child's play, when it became necessary to make several lode locations in width, to cover the whole of the mineral outcrop, and to arrange the wording of the location notice to fit such conditions and at the same time comply with the requirements of the statutes.

The provisions of our mining laws relating to "extralateral rights" are applicable to the locating and working of veins and lodes of simple structure and of comparative narrow width, but fail in their application to the large outcrops of porphyry, containing disseminated copper minerals and other metallic ores, and to the complicated vein systems met with in some of our mineralized localities.

I believe it would be wise to allow our present mining law to remain in force as it applies to the locating and working of veins or lodes; it would fall into disuse, and become obsolete, and thus the bad effect of a sudden change from an established system of procedure would be avoided. I suggest that the provisions of our law relating to the location of placer ground be abolished, and in lieu thereof a new section be created, permitting the location of all forms of mineral deposits except coal and oil, in tracts of not more than 160 acres in any one location, such location to be exempt from any and all extralateral rights as provided in the present law, and any location thus made to conform to the legal subdivisions of the public land surveys where the mineral deposit occurs on surveyed land; and where the mineral is found on unsurveyed land, the location to conform to the limits of the mineral deposit as near as possible.

A copy of the location notice should be filed for record with the recorder of deeds of the county in which the location is situated: also a copy should be filed for record with the registrar of the U. S. Land Office of the district in which the location is made if the same is located on surveyed land.

Assessment work should consist of the expenditure of not less than $2 per acre, each year, for each acre claimed, and proof thereof, attested to by two witnesses, filed for record with both the county recorder and the registrar of the Land Office. The filing of the location notice and proof of labor with the registrar of the Land Office would prevent the acceptance of an application for patent for the tract in question without the Land Office having notice of the mineral character of the land.

It should be compulsory for the mineral claimant to make application for patent upon the expiration of seven years from date of location.

Fractional subdivisions of as small as five acres should be allowed on surveyed land. No location should be recognized on which the work done is not enough to expose indications of mineral sufficient to lead one versed in the surface indications of ore deposits to believe that a thorough exploration underground might expose a valuable mineral deposit.

Failure to comply with any or all of the conditions and provisions herein contained should render the ground open to location the same as though it had never been located.

E. E. SCHELLENGER.

Blythe, Calif.

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An Old-Timer Passes

THE EDITOR:

Sir—Your issue of Oct. 15 records the death of Henry C. Newton in his cabin at Lake Eldora, Colorado—an old writer of mining news and comment found dead in a log cabin. The announcement must have interested countless people throughout the West. "Old Newt" was a well-known and picturesque figure, and had traveled from Alaska to Mexico. It is not true, however, that he was a graduate of Yale, as your announcement suggests. He told me that he had never been east of the Mississippi. Your statement about his father, who is 101 years old and lives in Missouri, is correct, I believe, for I have seen Newt write to his "dad" for "a little money." He was accustomed to do this after a drinking spree, during which he sometimes excused his tippling by asserting brokenly that "a feller has to have a little recreation."

The log cabin in which Newt lived was at nine thousand feet altitude on the shore of a slender lake set amid the Rockies. The dark cabin contrasted with the gleaming water and the dazzling peaks. Inside, Newt cooked savory meals and proved a hospitable host. Although his stories needed some discounting, they were always interesting. His breezy manner and exaggeration were those of early days. He was opposed to Y.M.C.A.'s, and believed American women to be tremendously spoiled. The Mormons, he asserted, had the right idea for populating the West. For hours he could converse intelligently about things which he had seen or read of. Many a traveler has enjoyed his hospitality during hunting or prospecting trips at high altitudes. For years he was a type of the old-timer who "baches" in a little cabin while awaiting his last call—a relic of the old West of the wide-open, bluff times that will never be seen again. A lively, sociable little man was Newt, and he radiated a joy of living and a bonhomie that should be set down to his credit. Many a worse man than he has packed a bag of provisions and a jug up Colorado canyons. May he rest in peace!

P. B. MCDONALD.

New York University.

The Manganese Tariff and the Arkansas Industry

THE EDITOR:

Sir—Paul M. Tyler and Neal J. Halpin, of the U. S. Tariff Commission, recently visited the Batesville-Cushman manganese field in Arkansas, in connection with the survey of the domestic manganese districts now being made by the commission to determine whether the tariff on manganese ore shall be changed or not. They were accompanied by local operators, shown the various mines, and given data on probable ore reserves, and any other information available that might help them in making their decision.

Operators of the district, as a body, are protesting against any reduction being made in the tariff, realizing that if the duty is either removed or reduced the destruction of the industry will result. They point to the fact that the demand for reduction or removal of the tariff is not coming from the consumer, who is really paying it, but from owners of foreign ore deposits, and that their motive is a speculative rather than an economic one.

Since the tariff on manganese ore was established in 1922, a slow but steady development in the Batesville-Cushman field has taken place. The influence most retarding to development has been the malign threat from certain sources that the tariff would be removed. On the other hand, producers have been urged into greater production, which has kept them between the proverbial frying pan and the fire. Increased production meant increased development and equipment, which in turn meant increased outlay. To put more money into an industry that might be strangled to death at any time seemed foolish, and they have gone along doing the best they could, investing their money in such manner that it would bring in the quickest returns. The development of the Batesville-Cushman field since 1922 would probably have been three times as great if this tariff *loup-garou* had not always been threatening those engaged in the industry. All things seem to point to the fact that there are certain interests in the United States who do not want domestic manganese deposits developed and who will fight all efforts in that direction. That this condition exists is all the more amazing in consideration of the fact that, of all the metals, the development of a domestic manganese industry is of the greatest economic importance.

Other infant industries in the United States have enjoyed the protection of high tariff, and have not been constantly harassed by a pack of wolves, trying to strangle them in their swaddling clothes. There is no infant industry in the United States today that is more important than the manganese industry, and it should be left alone with its tariff nurse unmolested, until it develops a good, strong pair of legs to travel on. For the last few years its growth has been satisfactory, and anyone who is acquainted with the industry, who has any vision at all, can look a few years into the future and see the meeting place of the two curved lines, where domestic supply will meet or almost meet domestic demand.

If any change in the tariff is made, the trend should be up and not down, inasmuch as a growing child needs all the nourishment it can get. Twenty-five per cent added to the present tariff would give the industry a strong impetus, with a corresponding increase in production. In future years, after the industry were well established and functioning successfuly, the tariff support might be withdrawn gradually if that course were advisable.

Two rather important discoveries have been made in the field this year that promise a larger and more profitable production. In experiments made with concentration methods at the Miller-Rhinehart property, near Batesville, it has been found that the minute ore values contained in the chocolate-colored clays common to the field can be saved by tabling, and that by fine grinding and tabling the grade of all ores can be raised several points.

That the full extent of the deposits of manganese ore in Arkansas has never been determined has been shown recently by discovery of manganiferous clays in the vicinity of Marshall, in Searcy County. Assays show that samples of these deposits run as high as 45 per cent metallic manganese. The size and commercial value of the deposits have not yet been determined. A survey of the mineral resources of North Arkansas, now being conducted by the State Geological Survey in conjunction with the U. S. Geological Survey, will include this new manganese territory, and much more information will be available when the reports are printed.

Under moderately favorably conditions, Arkansas can increase its manganese production many times within the next few years. It cannot do it, however, without a protective tariff, as that is the deciding factor between profit and loss. If the industry is to develop to that point where it will eventually take care of domestic demand, operators must be assured not only of a tariff that will permit them to make a profit on their operations, but also of the fact it will be stable and that they will not be constantly harassed with the question in the future, which now keeps the industry in an unsettled condition.

Mountain Home, Ark. TOM SHIRAS.

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Selection of a Stoping Method

THE EDITOR:

Sir—Mr. W. G. McBride's discussion of the second article of my series, entitled "Selection of a Stoping Method," which appeared in the issue of Sept. 24, brings out some interesting points. The possible effect of the stoping method on the subsequent metallurgical treatment of ore mined is an important consideration in some operations, and Mr. McBride mentions two interesting examples—the Maggie orebody of the Old Dominion company at Globe, Ariz., and the Sullivan mine in British Columbia—the first being a copper deposit, and the latter one of lead and zinc.

A similar example was that at the Coronado mine of the old Arizona Copper Company, at Morenci. Here, the ore between the 300 and 400 levels averaged 3½ per cent copper in the stopes, but when sent to the concentrator, after being broken for several years, the grade was found to have dropped considerably, as a result of oxidation. Observations also seem to indicate that at certain steam-shovel properties in the Southwest there is an appreciable loss of copper where the ore is broken too far ahead of the steam-shovel operations.

A noticeable example of the effect of mine fires in oxidizing copper ore is that of the Capote mine, at Cananea, where a fire occurred some years ago and considerable water had to be used in cooling the hot area. This had a tendency to tarnish the sulphides and rendered flotation more difficult.

On the other hand, flotation is used at all the large

porphyry properties. At many of these shrinkage and caving methods are used, which break up the ore considerably in advance of the metallurgical treatment.

Practically all variations of stoping methods, with the exception of the open stope and filled stope, result in more or less pressure and friction, which, in turn, produce the heat that causes oxidation. Open stopes generally give a low cost, but their field is limited. Filled stopes are the most expensive.

Where ores oxidize readily, such as the examples mentioned above, the metallurgical problems must, as Mr. McBride states, be considered along with the selection of the stoping method, and the probable loss in oxidation and additional cost of treatment must be weighed against the increased cost of a stoping method that will eliminate excessive pressure and friction. However, in all cases, the ultimate selection will necessarily be governed by the total value of the metal content of the ore.

The rate of oxidation of different classes of ore when broken in stopes is a subject about which only too little is known. At present it would appear that the copper properties in which oxidation becomes a serious problem are in the minority, but it would be extremely interesting if other readers who have come in contact with examples similar to those mentioned, as well as a number of the lead-zinc operators, would contribute their experience, so that sufficient data might eventually be accumulated which would be of value both to the mining engineer and the metallurgist. CHARLES A. MITKE.

Phoenix, Ariz.

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The Sequence of Mineralization

THE EDITOR:

Sir—The conclusions of Dr. Schwartz which were discussed by Mr. Hugh H. McKinstry in your issue of Oct. 15 recall an experience which I had some years ago that bears on the question. At a point about 800 ft. beneath the surface, in a long exploration tunnel that was being driven in Churchill County, Nev., we found a "nest" of "concretions," containing six or more symmetrical, rounded boulders, in each of which, chalcopyrite, pyrrhotite, and sphalerite occurred. These minerals occupied the centers, the adjacent material resembling that which forms along the contact of limestones and porphyrites. The shell consisted of hard compact silica. I recall the impression made upon me when I noted that the chalcopyrite and pyrrhotite had been deposited contemporaneously with the sphalerite from the same mineral solution. We had investigated and had arrived at the conclusion stated. One of these "concretions" was given to the Smithsonian Institution at Washington. Another was sawed in two. Discovery of these "concretions," which gave us specific information as to what the primary mineral solutions contained, was especially interesting, inasmuch as it afforded a key as to what we might expect when the mineral zones were intersected. Perhaps a careful study of the specimens which are undoubtedly available at the Smithsonian Institution would throw some light on the question in which these gentlemen are interested.

Incidentally, I came to the conclusion some years later that these "concretions" had first been a citrous fruit, which had been trapped in sandstones that later became quartzites. This is quite another story, however, and not directly pertinent to the present subject.

Lovelock, Nev. JOHN T. REID.

By the Way

Not That Kind of a Pearl

"PEARL Ore Susceptible to Flotation," says a headline in *Mining Truth*. Looking further, to see if the oyster shells were ground up in a salt-water circuit, we found the subject of the article to be the ores around Pearl, Gem County, Idaho.

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When Shooting Stars Shoot

WHEN meteors are falling, it is no time for honest men to be abroad. A subscriber writes that one fell, hissing through the air, in Marshall County, Indiana, a week or so ago, narrowly missing a resident when it hit the ground two feet behind him and buried itself in the cement-like gravel highway more than fifteen inches deep. Had not the man secured the evidence to support his story one might doubt that the heavenly visitor struck so close. Such things are frequently deceptive. Lindbergh tells how, one night when his mail plane became disabled (or perhaps it was that it ran out of gas), he sent it into a wide spiral downward and took to his parachute. Landing safely, he set out to find the plane or what was left of it, to guard the mail. Man after man whom he met declared that he had heard and seen it fall and that it must be somewhere close at hand. It was finally located several miles away. So it is with meteors. But in the instance in Indiana the gentleman dug up the "meteor," a roughly oblong body twelve inches in diameter, and had the material composing it analyzed. Iron, gold and silver, quartz and carbon were reported. If this were but a brick that some friend had playfully shied at him it was an interesting brick. The missile is said to be on exhibition in Bourbon, where skeptics or enthusiasts may see it.

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The Aluminum Can

"EXIT the Tin Can" is the head given by the New York *Times* to a story to the effect that sheet aluminum has been found an acceptable substitute for tin plate in the manufacture of containers for the preservation of food. This is not the first substitute that has been heralded to take the place of the lowly tin can, several other metals as well as glass having been suggested. But the familiar container still monopolizes most of the space on grocers' shelves and in the kitchen pantry, where, with its attractive label, it is considerably more sightly than in its final appearance on the garbage dump. "Tin at $1,500 a ton!" exclaims the *Times,* insinuating that the price is excessive; but aluminum sells for half as much, and if sheet metal be used, as is proposed, it is safe to say that the aluminum in an aluminum can would be worth more than the tin in a tin-plated can, and thus the original price of the can could not be lowered. However, it is to be presumed that most of these aluminum cans would be picked up by the junk man and the metal would thus find its way back to industrial use, as do most of the tin cans used in large cities. Aluminum would not seem to be a satisfactory metal to be used when the contents of the can is at all alkaline, but this condition rarely obtains. Also, an alloy would apparently be desirable, tougher than pure aluminum. Soldering might also be a difficulty.

NEWS OF THE WEEK

Summary

LONDON maneuver intended to support the price of tin is reported at Washington to have originated with interests about to float a tin company.

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Quincy mine, in the Michigan copper district, resumes operations in No. 6 shaft, after a week's shutdown following an "air blast" in No. 2 shaft which killed seven men.

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Results obtained in deep development work at the Sunshine mine, in the Coeur d'Alene district of Idaho, create a renewal of interest in the "dry-ore belt."

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Operations at the Senator mine, near Prescott, Ariz., are to be resumed by the Phelps Dodge Corporation, which has owned the property since 1889.

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Kirkland Lake district of Ontario establishes a new high production record; further expansion and much construction work prevail in the district.

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Ambassador Morrow appears to have made very favorable impression with Mexican officials and press. Plans visit to mining camp of Pachuca.

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Kalgoorlie gold mines, in Western Australia, are faced with a further increase in costs as a result of a new scale of prices placed on wood fuel.

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With three producing mines under development, the Clark Fork district of Idaho attracts the attention of mining interests.

* * *

Exploration and development work continues in the Pioche district of Nevada, despite low prices of metals.

President Increases Duty on Crude and Calcined Magnesite

Action Follows Public Hearings and Investigation of Costs of Production in the United States and in Competing Foreign Countries

BY A PROCLAMATION of the President, signed Nov. 10, the rates of duty on crude and caustic magnesite were increased from 5/16c. to 15/32c. per pound for crude magnesite, and from 5/8c. to 15/16c. per pound for caustic calcined magnesite. The proclamation establishing these increased rates reads as follows:

"Whereas in and by Section 315 (a) of Title III of the act of Congress approved Sept. 21, 1922, entitled 'An act to provide revenue, to regulate commerce with foreign countries, to encourage the industries of the United States, and for other purposes,' it is, among other things, provided that whenever the President, upon investigation of the differences in costs of production of articles wholly or in part the growth or product of the United States and of like or similar articles wholly or in part the growth or product of competing foreign countries, shall find it thereby shown that the duties fixed in this act do not equalize the said differences in costs of production in the United States and the principal competing country he shall, by such investigation, ascertain said differences and determine and proclaim the changes in classifications or increases or decreases in rates of duty provided in said act shown by said ascertained differences in such costs of production necessary to equalize the same;

"Whereas in and by Section 315 (c) of said act it is further provided that in ascertaining the differences in costs of production, under the provisions of subdivisions (a) and (b) of said section, the President, in so far as he finds it practicable, shall take into consideration (1) the differences in conditions in production, including wages, costs of material, and other items in costs of production of such or similar articles in the United States and in competing foreign countries; (2) the differences in the wholesale selling prices of domestic and foreign articles in the principal markets of the United States; (3) advantages granted to a foreign producer by a foreign government, or by a person, partnership, corporation, or association in a foreign country; and (4) any other advantages or disadvantages in competition;

"Whereas, under and by virtue of said section of said act, the United States Tariff Commission has made an investigation to assist the President in ascertaining the differences in costs of production of and of all other facts and conditions enumerated in said section with respect to the articles described in Paragraph 204 of Title I of said tariff act of 1922, namely, crude magnesite and caustic calcined magnesite, being wholly or in part the growth or product of the United States, and of and with respect to like or similar articles wholly or in part the growth or product of competing foreign countries;

"Whereas in the course of said investigation hearings were held, of which reasonable public notice was given and at which parties interested were given reasonable opportunity to be present, to produce evidence, and to be heard;

"And whereas the President upon said investigation of said differences in costs of production of said articles wholly or in part the growth or product of the United States and of like or similar articles wholly or in part the growth or product of competing foreign countries, has thereby found—

"That the principal competing country for crude magnesite is Greece;

"That the principal competing country for caustic calcined magnesite is British India;

"And that the duties fixed in said title and act do not equalize the differences in costs of production in the United States and in said principal competing countries, namely, Greece and British India, and has ascertained and determined the increased rates of duty necessary to equalize the same.

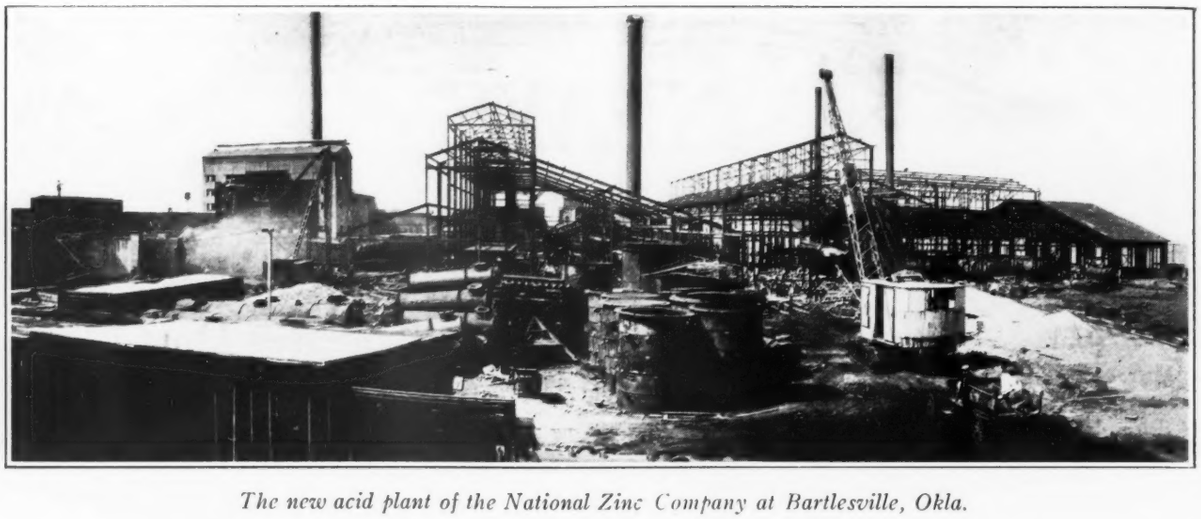
"Now, therefore, I, Calvin Coolidge, President of the United States of America, do hereby determine and proclaim that the increases in the rates of duty provided in said act shown by said ascertained differences in said costs of production necessary to equalize the same are as follows:

"An increase in said duty on crude magnesite (within the limit of total increase provided for in said act) from five-sixteenths of 1 cent per pound to fifteen thirty-seconds of 1 cent per pound;

"And an increase in said duty on caustic calcined magnesite (within the limit of total increase provided for in said act) from five-eighths of 1 cent per pound to fifteen-sixteenths of 1 cent per pound."

Strike at Golden Messenger

According to advices from Helena, Mont., high-grade gold ore has been encountered in the Golden Messenger mine, in the York district, 22 miles northeast of Helena. The property is being developed as a low-grade mine of large tonnage, but frequently deposits of high-grade ore are encountered.



The new acid plant of the National Zinc Company at Bartlesville, Okla.

Development Work Continues in Pioche Region

Combined Metals Uses Large Force in Exploration Operations—Bristol Silver Maintains Output

ALTHOUGH low metal prices have reduced production in the Pioche district of Nevada, development work has not sustained any decrease in volume. The Combined Metals mine is working a large force of men on development work, an average of 70 being now employed.

A shipment of 50 tons was made recently for testing purposes, but, aside from this, operations for the last six months have been confined to blocking out ore on the lower levels and exploration from the surface. During the last year churn drills have been prospecting the large estate owned by the Combined Metals Company which adjoins the main area held under long-time lease from the Amalgamated Pioche Mines & Smelters Corporation. Interesting and valuable results are reported to have been obtained in this work.

The Bristol Silver Mines are shipping approximately 100 tons daily to the Salt Lake smelters. This production has been maintained for many months, and the mine, which is owned jointly by the Snyder interests, of Salt Lake City, and the National Lead Company, is now one of the most productive properties in Nevada. Its monthly gross production totals more than $50,000, the principal metals produced being lead, silver, and copper.

The Pioche Mines Company, which has completed its flotation plant, is cleaning out and retimbering the Mazeppa shaft, through which access to the Burke and Yuba properties, productive fifty years ago, will be gained. Raymond Ely Extension Mines Company is sinking a two-compartment shaft east of the famous old Raymond-Ely mine to prospect the faulted segment of the Raymond-Ely ore channel. Tempuite mines, 90 miles from Caliente, are again shipping a good grade of silver ore to the Salt Lake valley smelters.

New Sulphuric Acid Plant Nears Completion

Construction of the new $1,000,000 acid plant of the National Zinc Company, now in progress at Bartlesville, Okla., will be completed early in December, according to a statement our representative has obtained from B. Elkan, president of the company. The initial capacity of the plant will be 3,000 tons of high-grade sulphuric acid per month, which capacity will be raised to 4,500 tons by the middle of January. Ultimate capacity of the plant will be between 6,000 and 7,000 tons. The photograph above shows the stage of construction at the beginning of October.

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Cleveland-Cliffs and Oliver Companies Plan New Work

The Cleveland-Cliffs Iron Company is preparing to open a new open-pit mine on the Marquette range to replace the Ogden mine, which will ship its last ore in 1928. The new property, on the site of the old Tilden lands, south of Ishpeming, contains a large deposit of low-grade siliceous iron ore, averaging 40 per cent iron and 39 per cent silica. About two miles of railroad will be built to the property by the Lake Superior & Ishpeming Railway Company, which serves most of the mines of the range. A large crushing plant will be installed. Dump cars will be employed to transport the product from pit to crusher. It is planned to employ water to wash away the small amount of overburden that lies on the ore.

At a depth of 2,850 ft. a drift is being extended to connect the Davis and Geneva mines of the Oliver Iron Mining Company, on the Gogebic range, and open up what is virtually new mining territory. The Geneva shaft is down 3,150 ft. and will be sunk to a depth of 4,000 ft. The drift, which is now in a distance of 700 ft., will be 2,000 ft. long. A number of improvements are planned to bring the present surface equipment at the Geneva property up to date.

Quincy Mine Resumes Operations in No. 6 Shaft

"Air Blast" Leaves Considerable Rock in No. 2 Shaft—Rescue Workers to Receive Gold Medals

OPERATIONS have been resumed in No. 6 shaft of the Quincy mine, in the Michigan copper district, after a week's idleness caused by the tragedy in No. 2 shaft Oct. 29, when seven men lost their lives in an "air blast." Plans to resume timbering in No. 2, which was damaged by fire last July from the 53 level upward, have been made. Timbering had reached the 41 level when an "air blast" killed seven of the timber crew. An examination of the shaft this week showed it to be in good condition as far as timbering had proceeded. There is considerable rock in the shaft between the 41 and 47 levels, as a result of a series of blasts, and this rock must be removed.

In recognition of the heroism of the Quincy miners who risked their lives under perilous conditions to recover the bodies of their seven comrades killed in No. 2 shaft, citizens of Hancock, Mich., will present to them gold medals and certificates of appreciation. The presentation will be made at a public gathering.

The new amygdaloid vein opened by Calumet & Hecla Consolidated in a crosscut from the 410 level of No. 2 Allouez shaft is 1,400 ft. west of the shaft and 600 ft. west of the Calumet conglomerate. The copper content is encouraging, and the lode will be extensively opened to determine its possibilities. It appears to be an entirely new vein, not having been identified with any of the other copper-bearing formations in the district.

The long drift from Calumet & Hecla Consolidated's North Kearsarge No. 4 shaft south to Centennial, on the 34 level, has about reached its objective. It is more than a mile in length in the Kearsarge vein. It has opened rich ground, particularly beneath Wolverine, and in South Kearsarge and Centennial. Three shifts of men have been

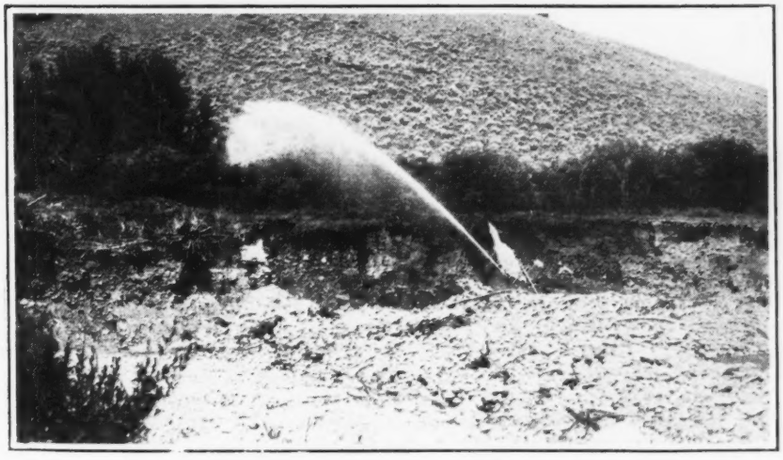
pushing this work. The advantages of the Calumet & Hecla consolidation are apparent in this and other openings from one property to another. Electric tramming makes rock transportation through long drifts quite simple, and elimination of boundary lines does away with the necessity of intervening shafts and shaft pillars, permitting the removal of all valuable ground. From Ahmeek No. 2 shaft, drifts have been extended well into Allouez territory from several levels, including the 29, 30, and 34. The mining of copper rock in adjacent properties in this way cuts costs and makes it profitable to mine certain areas not heretofore considered profitable.

Arcadian Consolidated now has about 300 ft. of openings in the Arcadian vein, which was encountered in a crosscut from the bottom or 1,250 level of the New Baltic shaft. The lode is well mineralized, and, on the whole, is pronounced commercial, averaging probably better than the New Baltic vein. Opening work in the formation will continue. It also is proposed to deepen the shaft several hundred feet to develop the lode at greater depth.

American Gem Working Two Sapphire Pits

Sapphires are being mined at the rate of approximately 20,000 oz. a year by the American Gem Syndicate on the West Fork of Rock Creek, in Granite County, Mont. Two pits equipped with hydraulic elevators and giants are being worked, and during the summer thirty-five men are employed in the operations, which are then on a two-shift basis. The accompanying photograph shows the lower, or smaller, pit.

The stones are not of gem quality and are hence largely utilized in the manufacture of bearings for electric meters and watches. Formerly, production averaged 25,000 to 30,000 oz. a year, and it is expected that the present rate of output will be increased to these figures as soon as more easily mined ground is again reached. An intrusive syenite stock is the source of the sapphires.



Mining sapphires in Granite County, Mont.

Cobalt Merchant Uses Mine Shaft Refrigeration

AS GOOD business sites in Cobalt, Ont., are scarce, an enterprising merchant there has built his grocery store around an old Coniagas shaft house. Besides having a good business location, this merchant enjoys a very economical type of iceless refrigeration. The shaft house is over a cold upcast shaft, and pipes have been installed to convey the cold air from the shaft to the cases where meat, butter, eggs, and other perishable foods are kept. Even on the hottest summer days the merchant has not found it necessary to buy ice. The store is shown in the illustration.

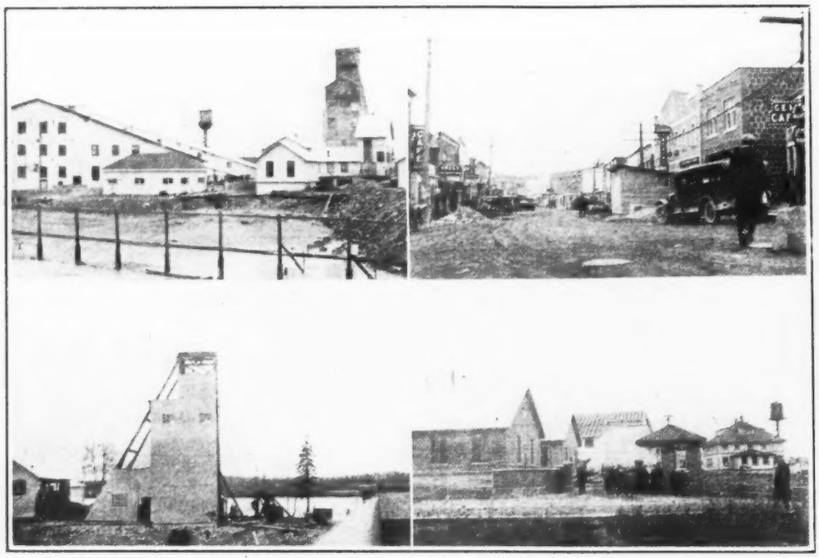
Sunshine Enters List of Dividend-Paying Mines

THE SUNSHINE mine, in the Coeur d'Alene district, Idaho, has apparently passed the long period of uncertainty and has definitely entered the list of dividend-paying mines. Last May the Sunshine Mining Company paid its first dividend, amounting to $30,000; similar dividends were paid in July and October, making $90,000 disbursed in about six months. After paying the last dividend, the company had a surplus of $100,000 in the treasury and no indebtedness outside of current operating expenses. Monthly shipments average from four to five carloads of concentrate, which return about $15,000 per car. These shipments, the chief value of which is silver, yield a net operating profit of between $35,000 and $40,000 per month.

The property is situated on Big Creek, in what is locally known as the "dry-ore belt." This section has been productive in a small way for many years, shipments up to recent years being limited generally to ore recovered from small shoots of gray copper carrying a high percentage of silver. The theory has long been held that deep development would find a change in formation more favorable to larger ore deposits, but the cost of testing this theory has prevented its being carried out until the present company took over the Sunshine mine several years ago. As the financial resources of the company are limited to the returns from the mine, deep development progressed slowly. A shaft was started from the lowest tunnel just above the level of Big Creek, and the development of the vein to a depth of 500 ft. proved most satisfactory. This work tended to confirm the theory of larger orebodies and the continuance of high-grade ore. From the 500 level, sinking is progressing following the vein, the purpose being to extend the shaft 700 ft. to a total depth of 1,200 ft. below the tunnel level. It is believed that by the time, or before, this depth is reached the Revett quartzite formation will be entered, in which formation the large Coeur d'Alene orebodies are usually found. At a depth of 200 ft. below the 500 the vein has been explored by 175 ft. of drifting. An oreshoot from 10 in. to 2 ft. wide and 2 to 3 ft. of lower grade ore were disclosed by this work. Samples of ore from this level indicate the showing to be the best in the history of the mine. Operations at the Sunshine have apparently proved the deep development theory, and have created a renewal of interest in the "dry-ore belt"; other deep development enterprises will doubtless follow.

Alaska Juneau in October

Alaska Juneau Gold Mining Company reports estimated results for October, 1927, as 324,000 tons mined and trammed to mill; receipts $216,000, or 66.67c. per ton; expenditures, $172,000, or 53.09c. per ton; operating profit, $44,000, or 13.58c. per ton; other expenditures and accrued charges, $20,500. Surplus for the month was $23,500.



Upper left—Lake Shore's mill and new shaft. Lower left—Temporary headframe over new shaft at Lake Shore. Upper right—Main Street, Kirkland Lake. Lower right—Entrance to the Teck-Hughes property, showing new shops and staff house

Further Expansion Current at Kirkland Lake Camp

District Establishes New High Record of Production—Teck-Hughes Completing New Milling Unit —Lake Shore Increases Capacity

THE KIRKLAND LAKE camp still has growing pains, and almost every month further expansion in some direction is taking place. During September the district again established a new high record of production, with a total of $928,638 from 69,404 tons of ore treated. This is an increase in output and a reduction in tonnage. The average grade was $13.35 a ton.

Teck-Hughes is making rapid progress with the second unit of its new mill, and, with this unit completed, before the end of the year, the total capacity of the property will be 850 tons a day or over. The old mill is treating about 250 tons, but, with the two units of the new mill in operation, at least an additional 600 tons, and probably more, will be treated. With 850 tons a day going through the mill, production should be around $500,000 a month; this output would place Teck-Hughes second only to Hollinger among the Ontario gold mines. Development is progressing on the lower levels of the property, and the ore zone has been cut at the 14 and 15 levels. On the 16 and 17 levels, crosscuts are being advanced toward the orebody, and similar work is soon to be started on the 18 and 19 levels. A crushing plant has been installed at a point between the 13 and 14 levels, and a similar installation will be made on the 19 level.

Lake Shore is putting in another tube mill, which will give a further 100 tons' daily mill capacity and will increase the present output, which is at the rate of about $250,000 a month. With the completion of the new shaft at this property it is probable that the mill tonnage will be given a further substantial increase. Wright-Hargreaves mill is now treating 700 tons daily, with a monthly production of a little over $200,000.

Preparations are being made at the Argonaut Consolidated Mines for the sinking of the new shaft. A new compressor has been ordered, capable of operating eight more drills. The management also plans to order a large capacity hoist as soon as developments at depth are up to expectations. The new shaft will connect at a depth of 500 ft. with the winze, which now extends from that level to a depth of 1,250 ft. Plans to raise the shaft to the surface and to sink to a depth of 1,500 ft. and probably farther are in preparation. The present winze will be made into a three-compartment shaft. This winze is in a favorable section of the property and once it is enlarged it will be continued to depth.

The mill of the Tough-Oakes Burnside is now treating 100 tons a day, instead of 50 tons, and the average grade in October was between $9 and $10, compared with a recovery of approximately $3 for some time. Arrangements are being made to finance the sinking of the main shaft to a depth of 2,500 ft.

Operations Resumed at Several Arizona Mines

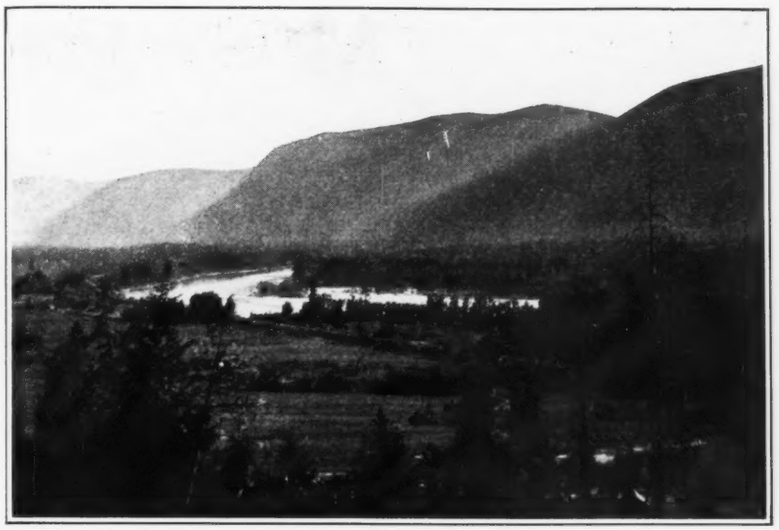
Phelps Dodge Corporation Sends Out Crews to Rehabilitate Senator Property Near Prescott

OPERATIONS at the Senator mine, near Prescott, Ariz., are to be resumed by the Phelps Dodge Corporation, which has owned the property since 1889. It was originally a gold and silver producer, but the precious metals decreased with depth, and base metals, especially zinc, increased. Maximum production was attained between 1889 and 1899. Since that time operations have been intermittent. During the war copper ore was taken from the Snoozer vein, but the mine has lain idle since the reaction in copper prices following the war. Development of selective flotation, however, has placed the old mine again on the list of potential producers. The company plans to send the production to the Humboldt concentrator. The two principal shafts on the property are the Senator and the Ten Spot. Most of the ore has been taken from the former. It is 835 ft. deep, and is intersected on the 635 level by a 3,400-ft. haulage and drainage tunnel. The first work to be done will be the rehabilitation of this tunnel. F. W. Nelson is in charge of operations.

Another base-metal property which is to resume production soon is the Aravaipa, in the western end of Graham County. The company has been carrying on a series of metallurgical experiments in the mill, which was constructed the first part of the year. Zinc and lead concentrates will be shipped on a small scale for the present, the lead going to the lead smelter at Douglas and the zinc being shipped east. Fifteen men are now employed at the property.

A body of high-grade silver-gold ore has been encountered in an upraise being driven on the 1,000 level of the Belmont Copper Mining Company. Work will be continued to determine the exact size of this ore find. This ore was originally opened up on the 1,150 level and a number of shipments were made to the Magma smelter. The ore, as encountered, is sorted, and the high-grade material is shipped to the smelter. That of lower grade is placed on the dumps for concentration later. Development work is also being continued in the lower levels, in the hope of cutting some of the other veins located on the surface. The shaft is down 1,600 ft. and crosscuts have been driven on the 1,150, 1,400, and 1,500 levels.

The Jerome Grande mine, near Jerome, is being made ready for operation. A headframe has been erected and the 838-ft. two-compartment shaft has been retimbered. A double-drum Allis-Chalmers hoist and Cameron pumps have been ordered from Los Angeles. Hoist house, machine shop, and bunk house for the property have just recently been completed.



In the Clark Fork district

Clark Fork District of Idaho Attracting Attention

Considerable Prospecting in Progress and Three Producing Properties Under Development—Expansion of Operations Expected Next Spring

WITH considerable prospecting activity in progress and three producing properties under actual development, the Clark Fork area, in eastern Bonner County, Idaho, is attracting considerable attention in Idaho's mineral industry and is coming to be regarded as a district with a future. The region lies in the valley which separates the southern Cabinet Mountains from the Coeur d'Alene Mountains and is near the discharge of the Clark Fork River into Lake Pend Oreille.

Present activity in the district dates from the discovery of the silver-lead vein at the Whitedelf workings. This property, which at present is the principal one in the district, began active development in July, 1926, and, up to the middle of October of the current year, had shipped 78 cars of high-grade lead-silver ore to the American Smelting & Refining and Bunker Hill smelters. A two-compartment shaft has been sunk to a depth of 70 ft. with the idea of exploring the property at depth before erecting a mill. Electric power supplied by the Mountain State Power Co. has been brought into the property. Operations at the Whitedelf have been largely of a development nature, and production so far has been almost entirely incidental to this work. Plans for the erection of a 150-ton mill next spring are under consideration.

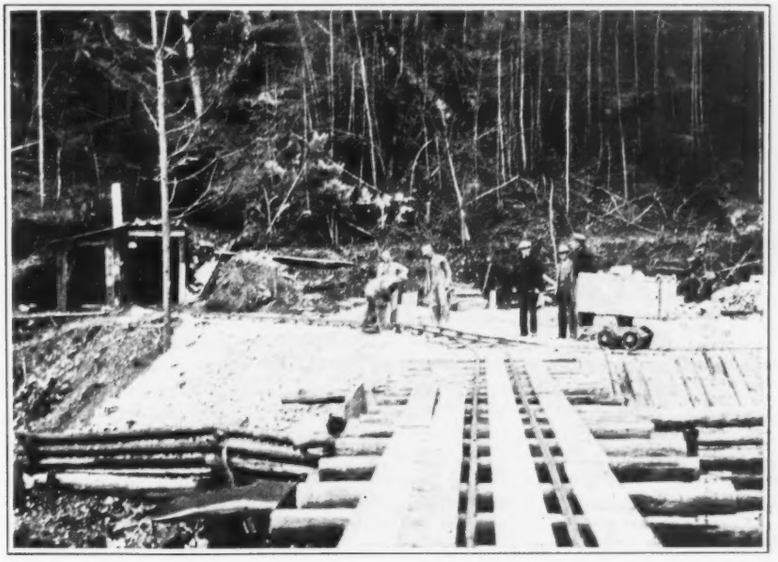
The Lawrence property is a comparatively old one in the district, having in its lifetime yielded an estimated return of $100,000. Most of this production occurred during the period when lead was about 4c. a pound. This property is the only one in the district that is equipped with a mill and shipping concentrates. All the other producing properties hand sort and ship ore that contains 48 to 70 per cent lead and from 40 to 60 oz. of silver per ton. The third producer is the Hope property, formerly known as the Elsie K, which on Oct. 1 had shipped 15 cars of ore since the first of July last year. Plans were recently completed for the exploitation of a group of eight claims situated on the north side of Goat Mountain. These claims, known as the Regal mining group, are said to contain exceptional ore occurrences.

In addition to the lead-silver deposits the area has copper and gold prospects which are attracting attention. The Copper Giant and Clarinda claims are the more outstanding copper prospects near Clark Fork, although the Carpie, near Cabinet, is another important prospect. The gold prospects are on Trestle Creek, west of Hope, and at the head of Wellington Creek, northeast of Hope.

The lead-silver deposits are the most significant economically at present. These are genetically related to masses of granite rocks in the form of stocks and batholiths which are intrusive into Belt sediments of pre-Cambrian age. The deposits near Clark Fork occur in the upper part of the Wallace formation, and are in an area that has been tremendously faulted, being near the course of the Hope fault — a displacement of great magnitude. Fracturing and fissuring, accompanying the faulting, provided channel-ways for the circulation of mineralizing solutions and the deposition of the lead-silver minerals. The lead-silver deposits occur in two forms: first, as tabular masses or fissure veins cutting the bedding of the sedimentary rocks at a high angle, and, second, as blanket or bedded veins which follow closely the bedding of the sedimentary rocks or cut it at a slight angle.

Early this year, several interests in the district requested the Idaho Bureau of Mines and Geology to make a comprehensive study of the geology of the region. Alfred L. Anderson, of the bureau staff, was detailed to the task and spent most of the summer in the Clark Fork region.

There is a considerable degree of optimism in Idaho over the possibility of the Clark Fork district becoming an important lead and silver producer. The Whitedelf is one of those exceptional properties that has been profitable from the grassroots, and, with considerable prospecting being done in the district by dependable parties actually seeking mineral bodies to develop, the immediate future outlook is encouraging.



Pearl No. 1 tunnel on the Whitedelf property

Washington Letter

By Paul Wooton
Special Correspondent

Details of London Maneuver to Support the Price of Tin Announced

Washington, Nov. 13—Details of the London maneuver intended to support the price of tin have just been reported to Washington. The report that an association was about to be formed by the leading producers to control the output and price of tin had its origin with interests about to float a tin company. Those concerned had suffered heavily as a result of the slump in tin prices. Their situation had become more precarious through the failure of a merchant firm which had caused liquidation which tended to depress quotations further.

Finding themselves in a desperate situation, an attempt was made to improve the situation by creating the impression that the leading producers were about to form an association for the above-mentioned purposes. A meeting was actually staged, but Williams-Harvey, Eastern Smelting, the Straits Trading Company, the Patiño interests, and other large producers were not aware that such a meeting was being held. Dutch tin interests likewise were not invited, and had no knowledge of the meeting.

As it must have been apparent to the interests concerned that the report would be discounted immediately at the London Metal Exchange, it is assumed that the purpose was to stimulate American buying. Probably the thought was that some time would be required for refutation of the report to gain circulation in this country. The opinion, also, probably was that this buying, combined with the professional effort, in progress at that time on the Exchange, to boost tin prices, would make for a situation favorable to the floating of tin shares.

The Duty on Tungsten

Information being gathered for submission to the Ways and Means Committee of the House and the Finance Committee of the Senate shows that 287 men were employed in the six domestic tungsten mines during 1926. As the total consumption of tungsten concentrates is 3,800 tons a year, it is figured that the consumers paid a penalty of $1,627,920. This is equivalent to the paying of a bonus of $5,670 per year to each of the 287 persons employed.

The Tariff Act of 1922 provides a duty on tungsten ore or concentrates of 45c. per pound of contained metallic tungsten, which is equivalent to approximately $7.14 per unit of WO_3, a unit being twenty pounds of WO_3—tungsten trioxide. Domestic production is at the rate of 1,380 tons per year. In 1926 the total sales price of the domestic production was approximately $920,000, or about $11.10 per unit WO_3 delivered at Eastern steel plants. During 1926 and 1927 the approximate number of employees in the tungsten mining industry was as follows: Mill City, Nev., 30 men; Mina, Nev., 12 men; Atolia, Calif., 20 men; Boulder, Colo., 125 men; Homestake, S. D., 30 men; Bishop, Calif., 50 men (now closed), or a total of 287 men.

During 1926 the average price of Chinese ore delivered in the United States was about $3.60 per unit WO_3. Adding to this the duty of $7.14 per unit, the average price paid by the steel plants for Chinese ore was $10.74—the 1927 price is slightly lower, being $3.20 without the duty, or $10.34 duty paid. During 1927 the domestic price is about $10.50 per unit.

Along with the material which will be submitted, attention undoubtedly will be called to the fact that an industry which is protected by a duty of approximately 200 per cent is able to furnish only 36 per cent of the ore required in the country at the direct subsidy to such producers of $428.40 per ton for 1,380 tons, or $591,192.

Tungsten ore is very important in the ordinary commercial steel business, but it is of vital importance in the case of war. The known and prospective amounts available in the United States are very small, and it is argued that it would seem the part of ordinary common sense to keep what we have available for use in an emergency, in case foreign supplies are shut off.

Anaconda Replaces Obsolete Milling Equipment

The Anaconda Copper Mining Company has for some time been remodeling its crushing plant at Anaconda, Mont., to increase the general efficiency and simplify the flow sheet. Other improvements made in metallurgical practice at this plant have required a finer grinding before flotation, and, accordingly, the classification section of the copper flotation concentrator is now being remodeled. The 42 small Dorr classifiers which have been operating in closed circuit with the mills since 1917 are being replaced with a similar number of larger and more heavily constructed classifiers of the same manufacture but of the most recent type.

Consolidated Builds Road at Cost of $33,000

The Consolidated Mining & Smelting Company of Canada has completed a wagon road, at a cost of approximately $33,000, connecting the Old Sport mine with Jeune Landing, where the Dominion government is erecting a substantial wharf so that the company may unload heavy machinery for the mining plant and concentrator at the mine.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Price of Fuel Wood Increases and Raises Costs at the Kalgoorlie Mines

Melbourne, Oct. 11—The Kalgoorlie gold mines are faced with a further increase in costs. Owing to a new award, the company which supplies timber—the only economic fuel—has announced that from the beginning of October the price of fuel, which was increased to 16s. per ton in August, will be further increased to 17s. 6d. per ton. The commission which investigated the position of the Kalgoorlie mines several years ago referred to the high cost of power generation at the mines and suggested that economies would result by the purchase of power from a central power station. The Western Australian government subsequently made proposals to the mining companies on the subject, but nothing has been done, owing largely to the unwillingness of the companies to incur the expense involved. Whether this action of the firewood company will result in united action, or will simply mean a further contraction of operations, remains to be seen. In the present state of the industry, any increase in cost is a serious item, as it appears to be the policy of the London directors to keep the mines open just so long as the revenue exceeds the expenditure.

Failing the installation of a central power station it is quite probable that one or two of the mines may decide on the adoption of wood-fuel gas-producer plants, which have proved satisfactory on other Western Australian fields and which would be more economical and efficient than the steam plants now in use.

The Western Australian government is introducing a bill to Parliament authorizing the construction of a railway line to Wiluna. A. Montgomery, the state mining engineer, favors the route from Sandstone, a distance of 110 miles, but several alternative routes are under consideration.

Virginia Mine to Reopen

The Virginia mine, three miles south of Coulterville, Calif., has been taken over by the Nevada Hills Mining Company Reorganized. The property is an old one and was worked for several years by the Virginia-Belmont Mining Company and before that by the White Gulch Mining Company. Operations were discontinued in 1923, and the company went out of business. A 1,000-ft. shaft and considerable drifting and cross-cutting represent the extent of development. Production was made for several years from a ten-stamp mill.

Mexico City Letter

By W. L. Vail
Special Correspondent

Ambassador Morrow Captures Imagination of Mexican Officials and Press

Mexico City, Nov. 1.—The new American Ambassador to Mexico appears to have made a very favorable impression. His concise, friendly statement, upon the occasion of his presentation to the President of Mexico, and the cordial, concise reply of the President, are considered a happy augury by all who really wish to see a friendly resumption of relations between the two countries.

Mr. Morrow has made a pleasing impression not only on the local Americans, but also on the other foreign residents. He has moreover captured the imagination of Mexican officialdom and the Mexican press, the latter speaking in the most optimistic terms of the success of his mission. Within 48 hours of his arrival, Mr. Morrow had presented his credentials, kept open house to meet local Americans, and accepted various invitations to visit sections of the country. One of the most important of these visits he will make is his week-end visit to the mining camp of Pachuca, four hours distant by automobile from this city. There he will obtain first-hand information concerning the mining situation of the country and the point of view held by American mining interests. The district is the most important silver camp in the world from a production standpoint, its output being approximately 185,000 tons of silver ore every month and 62,500,000 oz. of silver for the year 1926. The camp was worked by the Aztecs prior to the arrival of the Spaniards in 1519 and was worked continuously by the Spaniards up to 1827, when control of the principal properties passed into the hands of British capital.

IN 1906 the United States Smelting & Refining Company, of Boston, entered the Pachuca district and a little later was joined by the Camp Bird interests. American capital invested in the camp at this time probably amounts to $35,000,000. Opinions of American mining men in Pachuca ought to be of some value to the new Ambassador, who is apparently looking for facts.

Notwithstanding the mining crisis through which the State of Chihuahua has been passing, a number of mining companies, according to report, have been fortunate enough recently to run into rich ores, which enabled them to recoup some of their losses. Specifically, it is said the Magada mine, at Sabinal, district of Ascension, State of Chihuahua, has recently run into some high-grade ores of exceptional richness, which give promise of holding out. As a result, a large number of men are being placed on development work, and plans have been made to increase the capacity of the mill.

A general strike has been ordered, according to the press of this city, in the Ahualco, Etzlan, and Magadelena districts of the State of Jalisco by an organization known as the Mining Federation, which has Red proclivities. The principal property affected is the Cinco Minas mines, owned by the Gerard interests, of New York. The trouble originated with the recent assassination of the well-known Red agitator Pedro Ruiz, on the road from Mazata to Etzatlan, owing, probably, to rancor, still existing out of the strike at the Amparo properties. The union organization demands the retirement from the district of Colonel Nava Lopez, in charge of the local troops at Cinco Minas. These troops, known as the White Guards, are organized and paid for by the mining companies, but are under federal orders. The mining companies claim that the guards are necessary to their protection, and that it would be impossible to continue operations if they are withdrawn or indifferently officered. The state authorities have the matter in hand, but the federal government will be asked to intervene.

Nuestra Senora, at Cosalapa, State of Sinaloa, will suspend operations Nov. 15, because the Forrestry Department has withdrawn permission to cut timber on its own lands for fuel and mine timber purposes. This throws a considerable number of men out of work, and it is expected that the federal authorities in the City of Mexico may take a hand in the matter, in the hope of reopening the mines.

The Real del Taxco, S. A., State of Guerrero, has shut down its 25-ton smelter and intends to increase the capacity of the plant to 75 tons. In the meantime the company is increasing development.

M. & M. Society to Discuss Position of Lead

AT THE Harvard Club on Friday, Dec. 9, the New York Section of the Mining and Metallurgical Society will discuss the economic position of lead. Just two years ago a similar meeting was held at a time when lead was selling in New York at 9.75c. per pound. J. R. Finlay, who led the discussion, and about a dozen men prominent in the lead-mining industry expressed the opinion that no fear need be entertained as to the supply of lead; they argued that high prices would stimulate production. Today lead is selling for 6.25c. and is not too strong at that figure. At the forthcoming meeting Mr. Finlay again will be the principal speaker, and a number of well-known men have signified their intention of being present to help explain what has happened and to forecast what the future holds.

London Letter

By W. A. Doman
Special Correspondent

J. Mackintosh Bell Leaves Huronian Belt Group, Rumor Has It

London, Nov. 1.—Although it appears impossible to establish the absolute accuracy of the rumor that J. Mackintosh Bell has severed his connection with the Huronian Belt group of companies, there is apparently some foundation for the rumor. People who have discussed the matter with me express themselves as not a little surprised, for J. Mackintosh Bell has been regarded more or less as the guiding star of the Huronian Belt people. His views upon a mining proposition have generally been accepted as accurate, and he is looked upon as one of Canada's foremost mining engineers. It was upon his advice, I believe, that interest was taken over here in the Vipond. This has turned out a disappointment. Those concerned in a mining business do not usually give away its secrets, but as F. H. Hamilton, the head of the Huronian Belt, has recently returned from Canada, it is thought that his visit may have had something to do with the severance of relations with J. Mackintosh Bell. If there has been any break between the parties, it would seem to be particularly unfortunate just at the time when the visitors to the Dominion have returned so greatly impressed with the potentialities of the country's mineral resources.

ANOTHER matter that is unfortunate, or discouraging, is that certain engineers from Canada come to this country to interest capitalists in mining ventures, and meet with little or no support. Properties have been offered here recently by responsible emissaries who can scarcely get a hearing. There are two explanations of this kind of reception. In the first place, there is skepticism that anything promising would be allowed to pass out of the country, unless it went to the United States; and, second, finance houses say, "We have our own representatives in the country, and must leave the selection and recommendation of properties to them." This, I know, has occurred not once but several times.

A report is current that, to save the Keeley large additional capital expenditure, an arrangement is being made with the Mining Corporation for development of the Keeley from the corporation's drives in the lower horizons.

So far as it is possible to ascertain, little progress has been made with the proposal to stabilize the price of tin. The statement promised for last week end has not yet made its appearance, and delay is supposed to mean that many difficulties in the proposed plan have yet to be surmounted.

Situation at the Mines

Production in Non-Ferrous Metal Districts Shows Little Change—Interest in Zinc-Mining Operations Increases in Coeur d' Alenes

By H. D. Keiser
Assistant Editor

LITTLE CHANGE in the rate of production is noticeable in the non-ferrous metal-mining districts. Much new exploration and development work, however, is in evidence, indicating that general confidence in the mining situation prevails, notwithstanding the unsatisfactory conditions of the metal market. Increased activity is apparent in several sections, notably in the Coeur d'Alenes, where zinc-mining operations are being stimulated by the two new electrolytic zinc plants nearing completion at Kellogg and Anaconda.

Copper

Recent domestic and foreign buying and the slightly higher price for copper have considerably strengthened the position of the Arizona producers. Moreover, new finds at several of the well-known properties are again creating interest in copper mining in the West.

In October, shipments by boat from the Michigan copper district totaled 7,820,000 lb. of metal. Calumet & Hecla Consolidated and Isle Royale shipped 4,512,000 lb. from the Torch Lake docks; Copper Range and Mohawk moved 3,186,000 lb. from Houghton; and Quincy shipped 122,000 lb. Rail shipments were fairly heavy during the month. Shipments of copper by boat will soon be suspended until next spring, since navigation usually closes the latter part of November.

Lead and Zinc

With the price of zinc concentrate holding at $38 for the first three weeks of October, and with lead concentrate remaining at $80 during the entire month, production in the Joplin-Miami district continued to increase. The total concentrate weekly output reached a high point of 17,942 tons for the week ended Oct. 22 and stood at 17,504 tons for the next and last week of the month. Unsold stocks in bins were slightly in excess of 35,000 tons at both the beginning and close of October; this figure, however, dropped to 32,000 for the greater part of the four weeks' period. At the beginning of the month, 145 mills were operating, but on Oct. 29, when the price of zinc concentrate was reduced to $37, the number of active mills totaled 138. Further reductions in the number of mills in operation and in the output of the district are expected as a result of the lower zinc concentrate prices prevailing. During the last week of the month, 15,428 tons of zinc concentrate and 2,076 tons of lead concentrate were produced.

Production of lead and zinc by the mines of the Coeur d'Alene district, Idaho, during October was practically unchanged. With the exception of the Hecla Mining Company, which for the last few months has curtailed output to the extent of 10 or 15 per cent, production has been maintained on a normal basis regardless of the low prices of lead. In fact, this seems to be the practice of large lead producers in the West generally, although it can hardly be doubted that a slight reduction on the part of all would quickly be followed by a higher price. Much new development work is being carried on in various parts of the district, and this applies to both lead and zinc, indicating that confidence has been undisturbed by the unsatisfactory metal market. Zinc has come to be an important factor in the Coeur d'Alenes, owing to the construction of the electrolytic zinc reduction plant at Kellogg by the Sullivan Mining Company (Bunker Hill and Hecla). This, along with the new plant under construction by the Anaconda company, at Anaconda, has given an impetus to zinc development throughout the district, as these two plants will provide a market for all that is produced. The Bunker Hill lead smelter is making its usual output, operating two furnaces. Labor conditions are good and relations between employers and employees were never better. There are but few idle men in the district. The supply of labor, however, appears equal to the demand. Incidentally, the memory of the "oldest inhabitant" does not recall such a prolonged rainfall as has occurred this fall and still continues. However, it has not interfered with mining operations.

Lead-Silver

In Arizona, the lead mill at Bisbee and the lead smelter at Douglas, both owned by the Phelps Dodge Corporation, are operating satisfactorily. During the month, the new concentrator at Humboldt, which is treating complex ores, was put into operation. Owing to the low price of lead, a number of producers are curtailing operations. The Hillside property is temporarily closed down. A number of leasers are working the Comstock Silver property, near Kingman, and the mill of the Chloride Mining Company is treating custom ores from the vicinity of Chloride. Resumption of operations at the mill of the Aravaipa Mining Company is rumored.

Production at the lead-silver mines in the Bingham, Tintic, and Park City districts of Utah remained practically unchanged during October. Extensive exploration and development programs, which have been under way at many of the properties, were continued.

Gold and Silver

October production in the Tonopah district was estimated at $150,000 gross. The decrease, as compared with September, was principally the result of lower custom ore tonnage from Divide—while shaft sinking is in progress—and the closing down of the West End mill on Oct. 15. The West End has not closed its mine, however; it has 40 men underground as leasers and on company work. Production was too small to warrant the operation of the company's own milling plant, and the ore was sent to the Tonopah Mining Company's plant at Millers. There were no important developments in the district during the month.

Leasing was active in the Divide district on the Tonopah Divide, Brougher Divide and Belcher properties; some company work was done on Verdi and Gold Zone. October production was estimated at $15,000. Shaft repair work was still in progress on the property in the Hannipah district bonded to the World Exploration Company. Small work was started on other near in claims. The Eureka district was quiet, with some interest in claims and property transfers. Weepah continues quiet; the main property was closed Oct. 1.

Iron

The Lake fleet moved 6,722,758 tons of iron ore from Lake Superior ports during October, against 9,337,463 tons for the same month of 1926. Shipments for the year to Nov. 1 were 49,110,134 tons, compared with a movement of 54,563,371 tons for the corresponding period of last year. This is a loss of approximately 10 per cent, with the prospect of not more than 2,500,000 tons leaving from the mines during November, and practically none during the last month of 1927. Many of the Lakes freighters are now making their last trip for iron ore, after which they will tie up for the winter or enter the grain trade for a few weeks. Most of the pit mines have completed their shipments and many of the underground properties are now stocking at the mine.

The Oliver Iron Mining Company has suspended operations at its North Norrie mine, on the Gogebic range, as a result of the caving of the surface at a considerable distance from the mine workings proper. Slipping started on a dike, and cracks appeared on two streets in the city of Ironwood.

Book Review

Traveling, Seeing, Thinking

TO-DAY AND TO-MORROW. By J. H. Curle. 218 pp. London: Methuen & Co., Ltd. Price 6s. net.

AT 23, the author, after three years in the Transvaal gold mines, became "mining writer" for the Johannesburg *Star*. One of the first mines to be reported upon looked good to the engineer-journalist. He wrote a favorable account for publication and bought himself a block of shares, which were sold a week later at a considerable profit. A boom in Rand mines followed, and more money was easily made. Then Mr. Curle decided to return to his real work —mine valuation—but not before he had laid the foundation of an inquisitiveness that knew no bounds. "Gold Mines of the World" was issued about 1900. "My work was my pleasure," he says, as he recounts the journeys he made to every corner of the globe boasting of a gold mine of any consequence; before he was 35 he had examined over 500, in 38 countries. "I was in my stride," he says. "I knew my bent, the world, with its men and women. Mining was well enough; but travel, I knew, was better; so I passed on to that, and to a life more vivid than a thousand dreams."

His ambitions were realized. "I traveled. I saw. I thought," he reminisces. "The Shadow Show" was published in 1913; "This World of Ours" in 1921. Soon after the war a friend had said to him, "I want you to write a book with the gloves off." He promised to try, with the idea that it was to be about "Nature, Evolution, Race, Heredity, Environment, Sex, Mind and Matter, Cause and Effect, Good and Evil . . . in a blend of the human, the personal and the philosophic."

Our author continued to travel, to see, to think. The skeleton of the book "took form on the Congo and the Niger. The frame filled out at St. Paul de Loanda. The chapter on Nature was begun on Hudson's Bay, continued on Lake Nyasa and finished behind Rio de Janeiro. The chapter on Sex was begun on the sand dunes of Holland, continued at Lagos, and finished beside the Lake of Lucerne. That on Complexity was begun in the Pyrenees, continued in Rome, finished in Paris. Another was written in Arizona. . . ."

"To-Day and To-Morrow" is essentially a record of the thoughts and conclusions of an engineer on vacation, an engineer with a journalist's penchant for clarity and crispness of expression. In the introductory chapters he switches from place to place with the jerky movements of a humming bird in quest of food. Then the gloves come off, and we read of "Nature and Evolution." The vagaries of nature culminate in her treatment of man—raised to a position of unquestioned superiority in the animal kingdom, only to be dragged down and tortured by disease. Why, the author asks, the cruelty and wantonness and killing and flinging aside? Why did the ape-like creature take first place a million years ago? "Perhaps it was his way of handling nuts," he whimsically explains; and so on—a blending of acquired knowledge, seasoned with critical comment and tinctured with occasional evidence of contempt for medieval nonsense," as distinguished from "true religion."

Early in the book one comes across the author's main argument—"When inferior people are breeding so freely, the superior ones simply withdraw from the contest." The "riddle of nature" is discussed at length. The chapters on "Human Material" are of absorbing interest. Mr. Curle maintains that "from earliest historical times, the white peoples decimated each other by war." He deplores the perpetuation of the unfit, and sees in the blending of the whites with inferior peoples a threat to the future of the white race. The inevitable result of a lack of attention to eugenics is exemplified thus: "A Dutchman will breed a Friesland cow or a new tulip with infinite care, then, journeying to Java, he will casually turn out a family of piebald Malays." The Germans, he maintains, are a deadly efficient people. Mr. Curle avers that "what is good in the British comes . . . from about one man or woman in twenty-five"; but he credits the race with the qualities of being "practical, steadfast, seeing things through; a sense of fair play; respect for law and order." The watering down of the strain and the encouragement of breeding among degenerate types is deplored. Americans and British, he avers, are full of false theology, and under such conditions the unfit multiply. The future of Canada, as Mr. Curle sees it, will be a sort of federation with the United States. "All I ask," he says, disclaiming interest in the political aspect of the matter, "is that North America, one nation or two, shall be the eternal preserve of the best white blood." Of the South African natives he argues that "Evolution left them in the lurch, with a restricted cranium. . . . Australia is letting in too many Greeks. . . ." These are typical comments; but every nation is under fire.

In summary, he maintains that "in Great Britain there will be . . . deterioration . . ." from which no recovery is possible until the rights of those to be born are recognized. In the United States, the British strain may disappear outwardly, but many of its qualities will remain. "The Americans will become materially the greatest white people. . . . They, too, must face eugenic problems at once, or deteriorate." Germany he sees bursting with people and attacking France again in fifty years. Italy is being strangled by over-population. "Spain . . . is a perfect example of a nation flouting Heredity and the coming of Nemesis." Of the central American nations he maintains that their history so far has been "one long futility." In Brazil "the Portuguese strain has lost its fiber and will power. . . . The country is dealing Evolution deadly blows."

Mr. Curle believes that Russia will shake off her present troubles. "The Poles are an unstable people. . . . The Hungarians have not made good." Of the Rumanians he says, "Neither master nor man has yet contributed anything to Europe." Switching to Jewry, he says: "If we took, at random, six million Europeans, and matched them with the Hebrews, the Jews would be found outmatching the Gentiles in every way by ten to one. . . . If we can get the Hebraic Jews more and more to blend with the Gentiles, and their dominant strain to stay blended, we enrich our mentality for all time. . . ."

Of the Eastern races, Mr. Crule avers that "the Chinese are the most capable and efficient race in the world." Japan must collapse or restrict her birth rate. The country is leaving happiness behind because of over-population, poverty, and the slavery of industrialism. "Hindus . . . are spineless." The Malay peoples, according to our observer, are doomed, and Islam is riven by religious differences. "Out of Africa comes everything but mind. . . . The Negro, however, is the hero of Africa. . . . No such innate gentleman elsewhere exists. . . ."

Anticipating a "Period of Decline," Mr. Curle insists that "Men . . . are born profoundly unequal, and remain so. . . . Education is a two-edged sword. . . . If there must be free education, let us give only the grounding to one and all; let us reserve anything higher than that as a prize to be worked for, an honor, bestowed by the State on brains and character." He is of the opinion that Democracy will end in the bankruptcy of every State that sponsors it. In regard to a struggle of Labor against Capital that he anticipates, the fact is stressed that Capital stands for brains. He deplores the growing spirit of Nationalism. Mr. Curle discusses the problem of population and necessary food supply and anticipates that fertilizers will be used generally, even in the United States. He devotes considerable space to the predicted consequences of the exhaustion of the metallic deposits of the world, maintaining that coal will outlast all of them. The world, he avers, is being skimmed of its cream. "Americans are fast squandering their inheritance. In less than 50 years they will be drawing supplies from all the world, and the fine careless rapture of today will have passed."

The final chapters of the book deal with Sex, the Complexity of Life, Problems of Good and Evil, and a concluding summary is entitled "Gathering the Threads." The volume has been written by a traveler of world-wide experience, from personal observation and intimate contact; and, although all of Mr. Curle's views on the many subjects discussed are not likely to meet with universal approval, much of what he says is worthy of serious consideration.

A. W. ALLEN.

Recent Technical Publications

Specifications for Lubricants

AMERICAN LUBRICANTS. From the standpoint of the consumer. Third edition. By L. B. Lockhart. The Chemical Publishing Co., Easton, Pa. Price $5.

THE present volume is a further revision of a book first published in 1918 and revised two years later. It is now brought up to date and continues as an exceedingly valuable guide to all users of lubricants, explaining which grades of oil or grease are most desirable for various purposes and why, and giving the specifications for the lubricants recommended. It therefore devolves upon the buyer to select his lubricants by specification rather than by brand, a most desirable policy in many respects. Its principal disadvantage lies in the fact that the maker of a commodity sold on a specification basis usually confines himself to furnishing an article that meets the buyer's specifications, whereas if the goods are sold under a brand name, the seller is likely to feel more responsibility for complete satisfaction on the part of the consumer. Many lubricants are commonly sold almost entirely by brand, with no specifications mentioned; notably automobile lubricants. However, it is likely that the makers would cheerfully furnish specifications, if asked, and the data given in this book make it possible for the buyer to check up on some of the advertised claims for particular brands and see how they compare, in price and quality, for his purposes. E. H. ROBIE.

METAL MINE ACCIDENTS IN THE UNITED STATES: 1925. Bureau of Mines Bulletin No. 282. By William W. Adams.

The U. S. Bureau of Mines is to be congratulated on the very complete and interesting statistics contained in Mr. Adams' work. Accidents are classified both by kinds of metal produced (that is to say, accidents in copper mines, accidents in silver and gold mines, and so forth) and by mining methods. This last-named classification is of course the more interesting to the practical operator or the "safety-first" man. The bulletin can be obtained from Superintendent of Documents, Washington, D. C., for 20c.

DRILLING AND BLASTING IN OPEN-CUT COPPER MINES. Bureau of Mines Bulletin No. 273. By E. D. Gardner.

Mr. Gardner reviews current practice at the Utah Copper mine, Nevada Consolidated, Chino, New Cornelia, Sacramento Hill, and the United Verde open cut. The drilling methods and conditions governing their choice are reviewed. Drilling practice is summarized in tabular form. In dealing with the blasting practice, the bulletin gives sketches of the various arrangements of holes in the benches and contains much information on the classes of explosives used. The bulletin can be obtained from the Superintendent of Documents, Washington, D. C., for 30c.

FLUORSPAR AND CRYOLITE IN 1926. By Hubert W. Davis. Published by the U. S. Bureau of Mines, Washington. Price 5c.

Mr. Davis gives a very complete review of the domestic fluorspar production, by states, together with statistics covering production, domestic shipments, and imports. Complete lists of consumers, their purchasing agents, and of the producing companies are given.

ELECTRICAL PROSPECTING. In the July 16 issue of the *South African Mining and Engineering Journal*, Sven G. Petersson gives a brief description of two of the chief electric prospecting systems—the potential method and the electro-magnetic method.

GERMAN IRON INDUSTRY—The Verein deutscher Eisenhüttenleute has a new and attractive form of publication for its technical papers. These appear in a monthly bulletin—"Archiv für das Eisenhüttenwesen"—each paper beginning on a right-hand page and individually bound in the monthly issue, so that it may be easily removed and filed for reference with other papers of the same group. Furnace and rolling-mill practice is the subject of most of the papers, though mining also receives attention, as in a paper on "Gewinnung und Beförderung des Eisenerze aus den nordschwedischen Gruben von Gellivare and Kiruna." The first issue of this publication was dated July. The subscription price is 50 reichsmarks per year, single copies 5 Rm., from Verlag Staheisen M. B. H. Dusseldorf, Breite Str., 27, Germany.

SUNDRY BULLETINS—The following bulletins, which cannot be reviewed in detail because of lack of space, have been published recently:

Bureau of Mines Papers, obtainable from the Superintendent of Documents, Washington, D. C. Price 5c. each: "Barite and Barium Products in 1926," by R. M. Santmyers and A. Stall; "Antimony in 1926," by J. W. Furness; "Salt, Bromine, and Calcium Chloride in 1926," by A. T. Coons; "Chromite in 1926," by J. W. Furness; "Tin in 1926," by J. W. Furness.

The following larger bulletins are now available: "Technology and Uses of Silica and Sand," by W. M. Weigel, and "Quarry Accidents in the United States During the Calendar Year 1925," by William W. Adams. Price 40c. "The Ferric Sulphate Sulphuric Acid Process," by Charles G. Maier. Price, 30c. U. S. Geological Survey Professional Paper No. 151, "The Cephalopods of the Eagle Sandstone and Related Formations in the Western Interior of the United States," by John B. Reeside, Jr.

THE INDUSTRIAL TRANSITION OF JAPAN. By Maurice Holland. National Research Council, Division of Engineering and Research.

The book is a condensed report of the author's investigation of the industrial situation in Japan. His survey was made while he was attending the Pan-Pacific Science Congress as a representative of the United States Government. It is intended to distribute copies of the book to persons in the fields of banking, foreign trade, travel, aviation, fisheries, and science.

GEOLOGY AND ORE DEPOSITS OF MOGOLLON, N. M., are described by Henry G. Ferguson in Bulletin No. 787 of the U. S. Geological Survey. Copies may be obtained from the Superintendent of Documents, Washington, D. C. Price, 65c.

THE TOKLAT-TONZONA REGION and geologic investigation in northern Alaska are the subject of two papers by Stephen R. Capps and Philip S. Smith, respectively, which appear in Bulletin 792-C of the U. S. Geological Survey.

CHROMIUM.—*Commerce Monthly*, the journal of the National Bank of Commerce, New York, contains, in its October issue, an interesting article on chromium. The use of chromium has been expanding very rapidly of late years, and the recently discovered electro-plating processes are still further widening the commercial application to which the metal is adaptable. The writer in the publication named, after reviewing the various uses of the metal, traces the changes in the chief sources of supply which have occurred since 1830, when most of the world's chromium came from Maryland. Turkey at one time held a monopoly of supply, and today Southern Rhodesia and New Caledonia are the two major sources of the metal. The article includes an interesting table of the production of the principal producing countries of the world covering the years 1913 to 1925, inclusive. A brief description of the deposits and of mining of chromite in Rhodesia is given.

BRITISH DIATOMACEOUS EARTH INDUSTRY. The Sept. 16 issue of *Chemistry and Industry* (London) contains an account of the new plant at Hythe, near Colchester, England, of Moler Products, Ltd. Raw material is supplied from a large deposit in Denmark. This was recently purchased by Moler Products, Ltd. J. A. Agnew is chairman of the board of directors. The plant is equipped to manufacture insulating bricks and cement coverings for steam pipes, boilers, and similar apparatus.

AN APPLICATION OF FROTH FLOTATION TO OXIDE ORES. A. C. Vivian, writing in the September issue of the *Mining Magazine* (London), gives an account of his recent research work, conducted on Rhodesia Broken Hill ores.

THE *Mining & Industrial Magazine of South Africa*, May 18 issue, is a special Namaqualand number.

Personal Notes

CARL O. LINDBERG is in New York.

SAMUEL W. COHEN, consulting engineer, has returned to Montreal after two years visiting abroad.

SYDNEY H. BALL, of Rogers, Mayer & Ball, has returned from a ten days' examination in the South.

T. MARKS, of Lewis & Marks, Ltd., recently left Southampton on a business visit of a few weeks to South Africa.

F. E. WORMSER has left New York for a trip to the Pacific Coast, his sixth this year. He will return early in December.

G. A. SYME has resigned as manager of Inversiones del Oro; J. CLEVELAND-JONES has been appointed acting manager.

D. W. ROSSITER, of the New Consolidated Goldfields staff, with Mrs. Rossiter, has returned from England to South Africa.

ROBERT J. ANDERSON, formerly of 2416-38 Beekman St., Cincinnati, Ohio, is now with the Fairmont Manufacturing Company, Fairmont, W. Va.

F. L. BOSQUI has left Johannesburg temporarily and was recently in England. He is now in New York investigating metallurgical processes for the leading Transvaal platinum properties.

S. F. SHAW, consulting gas-lift engineer to producing subsidiaries of the Standard Oil Company of New Jersey, has left for South American oil fields, where he will be engaged during the next three months.

C. H. TOUYZ, managing director of the Pentouyz (Swazi) Tin Mines, Ltd., has left Pretoria for Swaziland, to arrange for starting mining operations for recovering tin from the company's concession on the M'Hlatusaan River.

L. O. HOWARD, formerly dean of the School of Mines at Washington State College, is giving lectures on mining and metallurgy at the Idaho School of Mines during the temporary absence of Prof. ERNEST W. ELLIS, who is abroad.

Prof. C. A. HEILAND, of the department of geophysics, Colorado School of Mines, spent the summer making geophysical measurements of a magnetite deposit in the Caribou mining district, Colorado, for the U. S. Bureau of Mines.

FRED HODGES has been appointed superintendent of mills for the Nevada Consolidated Copper Company, Chino branch, at Hurley, N. M. He succeeds J. T. SHIMMIN, who resigned to join the staff of the Southwestern Engineering Corporation.

G. H. CUNNINGHAM, of the Electrolytic Zinc Company of Australasia, Ltd., Melbourne, has recently completed a trip through Java, the Malay States, Siam, China and Japan, and is now in San Francisco. He will remain in the United States for some time.

D. L. H. FORBES, general superintendent of the Teck-Hughes Gold Mine, of Kirkland Lake, was granted the honorary degree of doctor of engineering at the centenary of the University of Toronto, which was celebrated Oct. 6, 7, and 8. Mr. Forbes was born in Scotland and raised in Toronto, attending various public schools and graduating from the University of Toronto in 1902 with the degree of bachelor of science. Later he did post-graduate

D. L. H. FORBES

work at Frieburg, in Germany, and subsequently obtained the degree of M.E. from the university. Among the positions he has held were general superintendent of the Globe Arizona Copper Co.; consulting engineer for the El Tigre Mining Co., Mexico; manager of construction for the Chile Copper Co.; and chief engineer of construction on an ammunition plant in France for the French government during the war. He was for a number of years Canadian representative for the Merrill Co., of San Francisco, and went to the Teck-Hughes in 1918, since which time he has brought this property from a dubious prospect to one of the foremost gold-mining properties in Canada.

E. G. LÉONARDON, engineer with the Schlumberger company since 1913, is now in charge of Schlumberger Electrical Prospecting Methods on this continent, with offices at 25 Broadway, New York City. SHERWIN F. KELLY, who has been associated with the same firm since 1921, is assistant manager.

DR. W. G. WOOLNOUGH, geological adviser to the Australian Commonwealth government, recently finished his preliminary examinations of the regions in Queensland where the indications for oil prospecting are considered most favorable, and returned to Melbourne, whence he planned to leave for Papua in September.

JOHN G. BARRY, whose office is in Room 613, Mills Building, El Paso, Tex., is in charge of the newly organized exploration department of the Howe Sound Company, and will be glad to hear of attractive prospects of any kind of mineral. The company has operating properties in British Columbia and Chihuahua. Mr. Barry was a recent visitor in New York City.

T. H. O'BRIEN, general manager of the Inspiration Consolidated Copper Company, has been named chairman of the General Greenway Memorial commission, which will supervise the placing of a bust of the late General John C. Greenway, former manager of the Calumet & Arizona and New Cornelia Mining companies, in the Hall of Fame, at Washington, D. C. The Arizona State Legislature has appropriated $5,000 for this purpose.

Prof. VICTOR J. TRUSHLEVICH, of the Academy of Mines, Moscow, left New York for Moscow on Nov. 9, after a six months' sojourn in the United States, visiting various metallurgical plants, selecting and purchasing machinery for the equipment of the first copper flotation plant for the Atbassar trust in Siberia. Professor Trushlevich is manager of this enterprise. Construction work will start at once, and the plant is expected to be in operation during next summer. Professor Trushlevich has engaged an American engineer for his assistant. This engineer will proceed to Russia soon.

OBITUARY

JUAN FELIX BRANDES died in London on Oct. 29.

JOSEPH TRETHEWEY, a well-known mining operator, died in Vancouver, Ont., on Oct. 22, at the age of 72 years. He was born at Bracebridge, Ont., and went to British Columbia when a young man. There he engaged in mining. He returned East in 1905, and in association with his brother, the late W. G. Trethewey, became actively interested in the Cobalt mining fields. He was one of the most successful operators in that camp. In 1910 he returned to British Columbia, and during the latter years of his life engaged extensively in lumbering.

HERBERT ALEXANDER EYE died on Nov. 4, 1927, at his home in Claremont, Calif., at the age of 56. Mr. Eye was well known among the mining and smelting fraternity, especially in Mexico and the Southwest. He first entered the smelting business in 1895, with the Arkansas Valley smelter in Leadville. From there he went to San Luis Potosi in 1900, for the American Smelting & Refining Company, and, with the exception of a few years, during 1912-15 was in the employ of that company until his death, serving in Mexico and in the United States more than 24 years. Mr. Eye is survived by a wife and three daughters.

MARKET AND FINANCIAL NEWS

Copper Institute Launched as Statistical Agency by Producers

Resembles Other Trade Associations—Activities Limited to Those Approved by Supreme Court—F. H. Brownell President of Organization

By A. B. Parsons
Associate Editor

AT THE start the activities of the Copper Institute, organized last week by the important copper-producing companies of the United States, will be to collect, compile, and distribute trustworthy and comprehensive statistics concerning the production, distribution, and marketing of copper. Promptness, completeness, and accuracy are to be emphasized. It will put into the hands of miners, smelters, refiners and sellers of copper at weekly and monthly intervals information that will present a remarkably complete picture of the position of the copper industry in respect both to production and to marketing. It will not formulate policies or advise member-companies as to any course of action. Its function will be simply to place the information before the members. Whether or not the copper-mining industry benefits in a financial way from the activities of the Institute—and, obviously, that is the hope—will depend upon how well the individual companies make use of a tool that is put into their hands. At the same time the facts will be available to the publishers of trade papers and the general press. Consequently, the buyers of copper will know the situation as accurately as the sellers. However, as the sellers exercise a direct control over many of the factors in the situation they seem to be in position to reap the benefits.

Modeled After Steel, Zinc, and Petroleum Groups

The organization has been hailed as marking "a milestone in the history of the copper industry." How important it will prove to be, and how much smoother will be the road of producers beyond this milestone, remain to be seen. The condition of the zinc, the petroleum, and the iron and steel markets in recent months indicates that an Institute in itself is not a panacea for the ills of an industry producing raw materials. Each of these industries has an Institute, and it is after these organizations that the Copper Institute is modeled, as emphasized in the announcement of the officials regarding the plans. Attention also is called to the fact that it is not the purpose of the new agency to interfere with the present activities of the Copper and Brass Research Association, or of the American Bureau of Metal Statistics. Rather, the plan is to supplement the work of these organizations. The statistics compiled will be more accurate and informing than those regarding copper that the A. B. of M. S. now distributes. The Bureau, however, is commended for the work it is doing, not alone with respect to copper but to the other metals, and there is no intention to interfere with these activities. On the other hand it seems possible that at some future time the activities of the Institute and of the Copper and Brass Research Association might be merged.

Carefully Avoids Infraction of Anti-Trust and Trade Laws

Naturally the formation of any trade association raises the question of possible infraction of the federal anti-trust laws. In this connection the constitution of the Institute as drafted is particularly clear. It says: "Any agreement, understanding, combination or arrangement, or any form of concerted action, to curtail production, increase prices, suppress competition or otherwise restrain trade or commerce, or to monopolize, or attempt to monopolize, any part of the trade or commerce of the country, is expressly excluded from the purpose or object of the Institute and contrary to the intent of these articles; and notwithstanding any act or thing done by or through the Institute, each member thereof shall be wholly free to conduct its business and manage its affairs in its own way, without accountability, legal or moral, to the Institute, or to any member or members thereof."

Furthermore, it is provided that the books and records of the Institute shall be open for inspection at all times by departments or bureaus of the government, and all reports distributed to members shall be furnished to any official public body or institution desiring to receive them.

Among the more important companies that already have expressed their intention to join, subject in some instance to formal approval of their directors, are the following:

American Metal
American Smelting & Refining
Anaconda Copper Mining
Andes Copper Mining
Braden Copper
Calumet & Arizona Mining
Calumet & Hecla
Cananea Consolidated Copper
Chile Copper
Consolidated Coppermines
Greene Cananea Copper
Inspiration Consolidated Copper
International Smelting
Kennecott Copper
Mother Lode Coalition Mines
Nevada Consolidated Copper
New Cornelia Copper
Nichols Copper
North Butte Mining
Phelps Dodge
United Verde Copper
Utah Copper
Walker Mining

Invitations have been issued to a number of other companies that are expected to take definite steps to join promptly. Hesitancy on the part of some has been based on the disinclination to reveal some of the data concerning their individual operations. However, none of the information is to be disclosed, even to members, except in the form of totals and aggregates. One of the principal assurances of the leaders in the movement is that there will be no leaks. The list of the names of the companies that already have decided to join, and the names of the officials and directors, that appear on the page facing this are the best evidence that the administration of the Institute will be of the highest caliber.

Foreign Corporations May Be Given Consideration Later

Any firm or corporation actually engaged in the business of mining, smelting, or refining copper is eligible to membership. No names of "foreign" companies appear in the list; but it is understood that in advising the authorities in Washington of the plan to organize, mention was made of the possibility that later it might be desirable to include companies other than those controlled in the United States. It is significant that the important smelters of custom ores are included in the organization. Through the medium of these companies, in conjunction with the companies whose ores are smelted on a toll basis and which are included in the list, it is believed that not less than 95 per cent of the copper produced in the Western hemisphere is represented.

The most interesting part of the announcement regarding the Institute is the copy of resolutions that are to be presented at the first meeting of the board of directors, scheduled for the

near future. It outlines the various statistical schedules that are to be supplied periodically by the various members. In all probability these will be approved substantially as they stand, though experience may show that alterations may be advisable after the Institute is well under way. Although members are urged to supply all the data called for in the schedules, the furnishing of any information will be voluntary and no member shall forfeit any right of membership because of failure or omission to do so either in whole or in part.

Hope to Develop Uniform System of Cost Accounting

One of the objects of the Institute is to develop a standard system of accounting for the ascertainment of *true* costs, including costs of production, transportation, and marketing. It is recognized that the figures usually published as representing the costs of producing copper are in many respects misleading. It is proposed that producing-mine members of the Institute should give to Price, Waterhouse & Co., a firm of chartered accountants, their "stripped" or "operating" cost figures, on a standard basis worked out by the accountants; and also their "true" cost figures, which will include depreciation and depletion at rates used in preparing tax returns, and will also include freight to customers and domestic and foreign income taxes, computed on a basis to be agreed upon between the executive committee and the accountants.

All figures given to Price, Waterhouse & Co. will be kept strictly confidential by them. They will compile from these confidential figures totals showing the stripped cost of copper on the total tonnage reported to them, and the true cost of copper on the total tonnage reported to them, divided into the following brackets: Less than 12c. per pound; between 12 and 13c.; between 13 and 14c.; between 14 and 15c.; between 15 and 16c.; and over 16c.

Because of the relation of chartered accountant to clients, these cost figures, except for the aggregate or tabulated results, will not be disclosed either to the public, the member companies, or to the officials of the Institute. So far as stripped figures are concerned the schedule will not reveal much, for the reason that virtually all of the tonnage will fall in the bracket "less than 12c." A very different situation, however, will be reported in the compilation of "true" cost; and a surprisingly large proportion of production probably will be found to cost more than 12c. per pound when costs are calculated as they should be.

It will be noticed that no mention is made of bond interest or interest on capital investment. The Supreme Court has held that in computing "true" cost of a commodity it is permissible to include a return on the capital at a rate representing ordinary interest on first-class securities. The theory is that after this is provided for, profits accruing as a reward for assuming the risks of business should be expected. It is understood that changes may be made in the basis for computing costs at a later date.

Three other classes of data are to be collected and tabulated for distribution. These are (a) production, (b) stocks, and (c) sales. To avoid duplication and at the same time assure a return as complete as possible, members are divided into two groups. The first includes companies that retain title to the copper until it is sold as refined metal and for whose account the metal is sold to consuming industry; the second, those that buy copper, blister or ore on the basis of quotations and sell on their own account. Where a company comes under both heads two reports are to be made, one as a "producer" and another as a "custom purchaser."

Officers and Directors of the Copper Institute

President

F. H. Brownell, first vice-president, American Smelting & Refining Company.

Chairman Executive Committee

C. F. Kelley, president Anaconda Copper Mining Company.

Vice-Presidents

Stephen Birch, president Kennecott Copper Corporation.

Walter Douglas, president Phelps Dodge Corporation.

Secretary and Treasurer

R. R. Eckert.

Members of the Executive Committee

The officers above listed.

R. L. Agassiz, president Calumet & Hecla Consolidated Copper Company.

James H. Anderson, secretary United Verde Copper Company.

Gordon R. Campbell, president Calumet & Arizona Mining Co. and New Cornelia Copper Company.

C. W. Nichols, president Nichols Copper Company.

L. Vogelstein, chairman of the board, American Metal Company.

(*a*) Production reports are to be made monthly as quickly as possible after the first of the month. "Producers" shall report either "Estimated recoverable copper contents of ores or concentrates shipped or transferred to smelting or leaching plants"; or, "Copper contents of blister produced at own smelting plant from own ores."

"Custom purchasers" shall report "Estimated recoverable copper contents of ores, concentrates, mattes, blister, scrap or other material containing copper or refined copper which was purchased."

Each company shall report monthly its production of refined copper; also its estimate of refined production during the next three months; showing both under each of the classifications—producer and purchaser.

(*b*) Stocks shall be reported as of the last day of each month. Each "producer" or its agent and each "custom purchaser" shall report its stock of refined copper at refineries, in transit, on consignment afloat, in warehouse, in customers' works either in U. S. A. or abroad or otherwise located, and of Bessemer copper which was shipped for other than refining, to which such reporting company has title on that date.

Domestic and Foreign Sales to Be Reported Weekly

(*c*) Current sales shall be reported each week:

1. Each company shall report its total tonnage of sales to that date for shipment during the current month and each of three subsequent months, separately for the domestic and export markets.

2. Each "producer" or its agent shall report its sales position in the following form: Total unfilled sales contracts (domestic and export) as of first of the current month for copper of all grades deliverable during the current and next three months, minus its stocks (as defined heretofore) on that date, plus sales contracts (domestic and export) made during the current month to date, deliverable during the same four months' period. The resulting sales applying against current and future production should be divided by the estimated daily rate (based on 30 days per month) of production to determine the date through which the production has been sold; for example:

To determine sales position on Oct. 10:

	Tons
Take unfilled sales contracts on Oct. 1	10,000
Less stock on Oct. 1	2,000
	8,000
Plus sales contracts Oct. 1 to 10 inc.	1,000
Equals sales applying against Oct. production	9,000
Production at rate of 300 tons per day. Equals sold through Oct. 30 or 20 days ahead.	

Similarly each "custom purchaser" shall report weekly as follows: Estimated balance of custom purchases undersold or oversold at the first of the week, plus estimated purchases during the week, minus sales during the week (including tonnages of scale contracts on which price has been determined during that week), leaving the estimated balance of custom purchases undersold or oversold, at the end of the week; for example:

To determine sales position on Oct. 10:

	Tons
Take undersold position on Oct. 3	400
Plus estimated purchases Oct. 4 to 10 inc.	1,200
	1,600
Less sales Oct. 4 to 10 inclusive	1,400
Leaves balance undersold on Oct. 19	200

The Institute shall compile and distribute these figures (but without disclosing the sales position of individual members) as follows:

(a) Every week, showing the combined position of all producers.

(b) Every week, showing the combined position of all custom purchasers.

3. Each company shall report weekly

its total domestic sales of electro (Prime Lake being considered electro) copper made during that week, showing the tonnage for each month of shipment, also segregation of tonnages and the average delivered price received by delivery districts. Tonnages of scale contracts should be entered during the week during which price is fixed. Similarly reports of domestic sales of all other grades combined should be made in the same manner and detail.

The Institute will compile these figures, reporting each Monday morning covering (a) electro (including Prime Lake) and (b) other grades combined, showing the total sales with segregation of months of shipments together with the tonnages sold and the average delivered price received for each delivery district as follows:

District 1—Baltimore, Md.; Bayway and Perth Amboy, N. J.

District 2—New England points; Hastings, N. Y.; New Jersey points (excluding Bayway and Perth Amboy); and Rome, N. Y., if canal delivery.

District 3—Rome, N. Y., if all rail delivery; Buffalo, N. Y.; Pittsburgh, Pa., district; Detroit, Mich., district; Ohio points; and Chicago, Ill., district.

District 4—Points west of Chicago, Ill.

Publication of Facts Should Stabilize Market

One of the difficulties under which sellers of copper have labored has been the lack of definite information as to the sales position of the selling group as a whole. Buyers, secure in the belief that they are unlikely to encounter an actual shortage of metal, have shrewdly "played" selling agencies against each other. The sellers have themselves to blame, in large measure, for price shading on their part has been a factor. A troublesome element has been the custom smelter, at whose door things frequently have been laid that were undeserved. The new régime should help relieve this situation. Incidentally, it may be remarked that most buyers would prefer a recognized and stable market, even if prices were a little higher. It is not so much the price-level itself that troubles them as the fear that some competitor is underbuying them, or that a sharp break may take place at any time. Light on the entire situation at weekly intervals may prove to be a good thing all around.

Later on it is not unlikely that the activities of the Institute will be expanded, to "further the interests of the copper industry"—to quote from the preamble of the constitution—in a broader sense. It may be that fabricators of copper products will be taken into the organization—a step that would be consistent with a tendency for the development of companies like Anaconda that operate on the "vertical" organization or "mine-to-consumer" principle. For the present, however, the members are miners, smelters, and refiners; and the object is to promote the interests of that portion of the copper industry.

Nigerian Tin Output Increased in 1926

ACCORDING to the *Mining Journal*, London, the highly prosperous year experienced by the tin industry in 1926, when prices were markedly on the up grade for the fourth year in succession, is reflected in the official report on the Nigerian mining industry by Langslow Cock, chief inspector of mines, which has just been published. The year was one of great activity, not merely as regards output but in prospecting and development work, and the whole tone of the report bears witness to the optimism and high expectations held regarding the future. Actual returns from the mine department were 10,595 tons of concentrates won, which was an improvement on 1925 of 1,658 tons. The gross value of the tin exported, 10,562 tons, was £2,217,046. This figure shows a steady gain since 1922, when the value of the return was estimated at £864,998. The improvement in output was realized chiefly in the second half of the year, when the return was 6,166 tons. So far this year imports into the United Kingdom have shown an increase of 1,150 tons, so that the output this year may reach 12,000 tons of concentrates, or, say, about 8,500 tons of metal.

The increases realized were fairly widely distributed, continues the writer in the journal mentioned, for, although the leading producer — Ropp — again showed some decline and was displaced by the Northern Nigeria (Bauchi), the following table, showing all producers in excess of 100 tons of concentrates, is not only longer than the similar compilation of last year but shows gains in the great majority of operations:

	1925 Tons	1926 Tons
N. Nigeria (Bauchi)	871	1,438
Ropp	1,274	1,186
Keffi	1,056	1,126
Ex-Lands Nigeria	420	569
Rayfield	412	528
Mongu	479	512
Naraguta	454	495
Jantar	359	405
Bisichi	447	364
Niger Company	229	338
Kaduna Syndicate	250	251
Anglo-Nigerian	208	232
Naragute Extended	193	204
Jos	176	202
Nigerian Base Metals	63	177
Nigerian Consolidated	111	170
Kaduna Prospectors	176	147
Gurum River	92	128
A. A. Davidson	90	120
Yarde Kerri	41	115
Ribon Valley	153	110
Monguna	147	103
Naraguta Korot	...	102
South Bukeru	63	102

Price of Lithium Drops

Heretofore the price of lithium has been quoted at around $65 per pound for 95 to 96 per cent grade in lots of a few pounds. Demand has been very slight. Recently, however, an improved process has been developed in Germany, so that the metal can be offered at less than half of its former price and in a higher degree of purity. High-grade lithium metal, of 98 to 99 per cent purity, can now be imported and sold in the United States for about $25 per pound, delivered. Those who wish to use it in research work may be interested to know that lithium is a soft, silver-white metal, with an atomic weight of 6.94 and a specific gravity of 0.59, the lightest known metal. It melts at 186 deg. C. Below 200 deg. it may be melted in the air, but above that temperature it bursts into flame. It decomposes water at ordinary temperatures. In the Periodic Table of Mendelejeff it appears in Group 1, along with hydrogen, sodium, and potassium.

STATISTICAL NOTES

Dome Mines, Ltd., in October produced bullion valued at $325,265, against $326,622 in September and $324,629 in October last year.

International Nickel Co. for the third quarter of 1927 reports net profits of $1,380,688, after federal taxes, depreciation and depletion. This compares with $1,394,923 in the June quarter, and with $1,314,432 in the third quarter of 1926. The net profit of the company for the first nine months of 1927 amounted to $4,183,318, against $4,089,122 in the like period of 1926.

Quincy Mining Co. has been authorized by the Michigan Securities Commission to sell 40,000 shares of stock at $25 to stockholders of record only, and charge the purchasers only $12.50 a share. The remaining $12.50 will be paid from the surplus of the company. Warrants will be issued by the company, which will stand as the payment for one-half of the par value of the shares. The Michigan law prohibits the sale of mining stock at less than par. The new arrangement will permit the company to raise $500,000, which will enable it to get back on a money-making basis.

Hecla Mining Co., operating in Idaho, reports for the quarter ended Sept. 30, 1927, net income of $251,021 after expenses, taxes, and depreciation. This compares with $416,933 in the preceding quarter and $496,838 in the third quarter of 1926. Net income for nine months ended Sept. 30 totaled $1,223,993 after the charges enumerated above.

Bingham Mines Co., including its equity in the Eagle & Blue Bell Mining Company, reports operating profit for nine months ended Sept. 30 of $297,239 before taxes, depreciation and depletion, comparing with $181,363 in first nine months of previous year. Operating profit for September was $20,268 before depreciation, depletion, and other charges, against $22,624 in September, 1926.

American Zinc, Lead & Smelting Company and subsidiaries for quarter ended Sept. 30, 1927, reports profits of $113,970 before depreciation and depletion, comparing with $12,703 in preceding quarter and $152,137 in third quarter of 1926. For nine months ended Sept. 30 profit totaled $223,165 before depreciation and depletion, against $382,988 in same period of last year.

The Market Report

Strength in Copper Features Metal Market

Silver, Zinc, and Tin Also Selling for Better Prices Than a Week Ago

New York, Nov. 15, 1927—The continued strength in copper, both in the United States and abroad, with good sales at higher prices, is the feature of the metal market for the week ending today. Silver, zinc, and tin prices have also advanced slightly, though the market position of these metals does not appear so firm as that of copper.

Copper Now 13½c., Delivered

Sales of copper in the week ending today have again been very satisfactory in the domestic market and considerably more than satisfactory abroad. The price for usual Eastern deliveries has advanced from 13⅜c. to 13½c., the last-named quotation having been realized on heavy sales yesterday and today. A good tonnage was also sold in the Middle West at 13⅝c. Today, some quotations have been made as high as 13⅝c. delivered in the East, though up to the hour of going to press that price had not been realized, as there were still sellers at one-eighth cent under this level. Tube, sheet copper, and brass manufacturers have all been actively in the market; abroad, it is said cable manufacturers have been heavy buyers, though they have shown little interest here recently. Most of the domestic copper sold has been for either December or January delivery, consumers buying somewhat further ahead than they have been in the habit of doing recently, evidently sensing a well-sustained advance in the market. The foreign price continues at 13.80c., c.i.f., with the buying practically all for prompt shipment. The indications are that the export demand is for immediate consumption and not for speculation. An encouraging feature of the copper situation at present is that the improved market comes as the result of a bigger demand rather than decreased production; the rate of world copper production in October was the greatest in history, with the exception of February, 1927, and November, 1926, and yet world stocks at the end of that month were the lowest for a long time. In other words, the increase that has been made in total production appears fully justified.

Lead Fairly Active; Prices Steady

Monotonous is the best word to describe the domestic lead market. Buying has been neither brisk nor dull; and prices have been uniform at 6.25c. New York and 6c. in the Middle West, at which levels a good business was done each day. One seller shaded the New York price on a few small lots. The American Smelting & Refining Company continues its contract price for the New York market at 6.25c. It has been at this level for about two months now, a comparatively long period for recent years. Prompt and November deliveries easily predominate, with a fair amount for December and a very little indeed for delivery after the first of the year. The statistics just released are not particularly significant. Refined stocks were down at the end of October, but there is no apparent decline in mine output.

Zinc Reacts Upward

Buying at 5.60c., St. Louis, was heavy, galvanizers feeling that such a low price was not likely to persist, and endeavoring to buy for future requirements so far as they dared. This buying, coupled with the fact that some producers withdrew from the market, caused an upward reaction, with the result that 5.65c. has been the lowest price for the last two or three days, and 5.70c. has been secured on some orders, largely for forward delivery.

Daily Prices of Metals

Nov.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
10	13.175	55 875	56.00	6.25	6 00	5.60
11	13.175	56.375	56.875	6.20@6.25	6.00	5.60@5.625
12	13.20	56.50	57.125	6.25	6.00	5 60@5.65
14	13.25	57.25	57.50	6.25	6.00	5.65
15	13.275	56.75	57.00	6.25	6.00	5.65@5.70
16	13.275	57.00	57.25	6.25	6.00	5.675@5.70
	13 225	56.625	56.958	6.246	6.000	5 642

Average prices for calendar week ending Nov. 12, 1297, are: Copper, 13.175; 99 per cent tin, 56.100; Straits, 56.550; N. Y. lead, 6.240; St. Louis lead, 6.000; zinc, 5.615; and silver, 57.350.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
10	58 1/8	58 3/16	63 1/4	257 1/4	251 1/4	20 5/16	20 7/8	25 11/16	25 1/2
11	58 3/16	58 3/16	63 1/4	259 3/4	253 3/8	20 3/8	20 15/16	25 13/16	25 9/16
14	58 5/8	58 9/16	63 1/2	264 1/4	258	20 3/8	21 5/16	26	25 3/4
15	59 1/16	59 1/16	63 3/4	261 7/8	256 1/4	20 11/16	21 3/16	26	25 3/4
16	59 5/16	59 5/16	63 3/4	262 5/8	256 3/4	20 13/16	21 1/4	26	25 3/4

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
10	4 86 3/4	57 1/4	26 1/2	84s11 1/2d	14	4.87	57 3/4	26 13/16	84s11 1/2d
11	4 86 3/4	57 1/2	26 1/2	84s11 1/2d	15	4.87	57 3/4	26 11/16	84s11 1/4d
12	4.87	57 1/2	26 11/16	.....	16	4 87	57 3/4	26 11/16	84s11 1/2d
					Avg.		57.583		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Statistics for October issued by the American Zinc Institute follow, the figures being in tons of 2,000 lb.:

Stock, Oct. 1	34,277
Produced	50,185
Shipped	48,239
Stock, Oct. 31	36,223
Shipped from plant for export	1,637
Average number retorts operating, October	76,168
Total retort capacity, Oct. 31	131,484

Better Tone to Tin

The technical position of spot Straits tin has been weak since the first of November, one reflection of this being the narrow spread between Straits and metal of 99 per cent quality. The position appears to be improved somewhat, however. London advanced sharply on Monday, and this buoyed the domestic price temporarily, though consumers were not interested to any great extent. Forward shipment is at a discount of less than ½c.

Silver Up to 57¾c.

The silver market was active during the week, advancing steadily to 57¾c. on Nov. 14, which is the highest quotation reached since Feb. 14. The cause of the advance is apparently a good demand from India for prompt shipment and buying for China account against sales of yen.

Mexican Dollars (Old Mexican pesos): Nov. 10th, 43⅞c.; 11th and 12th, 44⅛c.; 14th, 15th and 16th, 44⅜c.

Foreign Exchange

Closing cable quotations on Tuesday, Nov. 15, were: Francs, 2.93c.; lire, 5.44c.; and marks, 23.86c. Canadian dollars, ⅝ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 98 or 99 per cent grade, price of leading interest, 25c.; outside market, 24.30@24.80c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, spot business, range for the week 10¾@10½c. Little difference for forward delivery.

Cookson's "C" grade, spot, 16⅜c. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, Chinese, 99 per cent Sb_2O_3, 15½c.

BISMUTH—Per lb., New York, in ton lots, $1.85@$2.10. London, 8s.

IRIDIUM—Per oz., $110@$115 for 98 @99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $51@$52. Small lots bring up to $56. Several sales made at easier prices.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $72. Dealers and refiners quote the trade for refined metal, per oz., cash, $64@$65. Market moderately active.

QUICKSILVER—Per 76-lb. flask, range for week $127.50@$128.50, depending on quantity. Market firmer. San Francisco wires $129.33. London, £23; market firmer.

RHODIUM—Per oz., $50@$55; London £8@£11½, nominal.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Nov. 5.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn. c.i.f. North Atlantic ports, minimum 47 per cent Mn. 36@38c. Caucasian, washed, 53@55 per cent, 40c. Chemical grades unchanged from quotations in the Nov. 5 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10@$10.25. Western scheelite, $10.25@$10.50. Market dull.

Chrome, Iron, Molybdenum, Tantalum, and Titanium ores are unchanged from quotations in the Nov. 5 issue.

Joplin Ore Prices Unchanged

Joplin, Mo., Nov. 12, 1927

Blende	Per Ton
High	$42.25
Premium blende, basis 60 per cent zinc	$36.00@37.00
Prime Western, basis 60 per cent zinc	35.00
Fines and slimes, 60 per cent zinc	32.00@34.00
Average settling price, all zinc	37.99
Galena	
High	$82.50
Basis 80 per cent lead	80.00
Average settling price, all lead	81.14

Shipments for the week: Blende, 11,565; lead, 1,765 tons. Value, all ores the week, $582,590.

A further decline of the price for zinc ore was expected but did not materialize. Sellers disposed of 10,660 of the 14,020 tons produced, and the shipment was 905 tons more than the purchase.

Lead ore is moving more freely on account of the low price of zinc, yet only one large sale has been made from bin stocks.

Platteville, Wis. Nov. 15, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$37.75
Lead Ore	
Lead, basis 80 per cent lead	$80.00

Shipments for the year: Blende, 56,926; lead, 1,565 tons. Shipments for the week to separating plants, 2,473 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Nov. 5 issue.

Mineral Products

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market slack. London, Cornish white, per long ton, £18¼.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Nov. 5 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, 78@82 per cent, $90, f.o.b. furnace. Spot business dull; prices for 1928 not yet established. Spiegeleisen, 19@21 per cent, $30@$31 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 92@95c. f.o.b. works. Dull.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Nov. 5 issue.

Metal Products

ROLLED COPPER—Per lb., f.o.b. mill, sheets, 22¼c.; wire, 15¼@15½c.

LEAD SHEETS — Full rolled 9½c.; clipped 10c. per lb.

Nickel Silver, Yellow Metal, and Zinc Sheets unchanged from prices in Nov. 5 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the Nov. 5 issue.

Steel Prices Improve

Pittsburgh, Nov. 15, 1927

Conditions as to prices have been disturbing steel makers more in the last few months than the volume of demand, which, though relatively light, has been perfectly well sustained since July 1 at a uniform rate, resulting in steel ingot production at close to 70 per cent of full capacity in the last four months.

Developments of the last week have been distinctly favorable. The 1.75c. minimum price on bars, shapes, and plates announced at the middle of September was well maintained, and last Thursday the Carnegie Steel Company announced that it had established 1.80c. as its minimum, with $2 a ton advance for less than carload lots.

Pig Iron—The Valley pig-iron market remains dull, and quotable at $18 for bessemer, $17 for basic, and $17.50 for foundry, although these prices are considered largely nominal.

Connellsville Coke—The market remains dull and prices have grown still easier, as low as $2.50 being done on heating coke. Standard furnace coke has gone at $2.75, against the former minimum of $2.85, making the market $2.75 to $3. Spot foundry coke remains at $4 to $4.75 for standard grades.

Freight Rates on Metals, Ores, and Concentrates

Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$11.40	$9.40
Garfield, Utah	Perth Amboy	12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy	14.50	12.50
Miami, Ariz.	Perth Amboy	14.50	12.50
Anaconda, Mont.	Perth Amboy	12.50	.....
Butte, Mont.	Perth Amboy	12.50	.....
Humboldt, Ariz.	Chrome, N. J.	14.50	12.50
Douglas, Ariz.	Perth Amboy	14.50	12.50
Globe, Ariz.	Perth Amboy	14.50	12.50
Clifton, Ariz.	Perth Amboy	14.50	12.50
Clarkdale, Ariz.	Chrome, N. J.	14.50	12.50
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	12.50	.....
McGill, Nev.	Baltimore, Md.	12.90	.....
Houghton, Mich.	New York	9.60	.....
Hancock, Mich.	New York	9.60	.....
Hubbell, Mich.	New York	9.60	.....
Dollar Bay, Mich.	New York	9.60	.....
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	14.50	$12.50

Marine Freight Rates

New York to

Hamburg	$6.50	per gross ton copper and lead
Liverpool	6.50	per gross ton copper and lead
Antwerp	6.00	per gross ton copper and lead
Havre	5.50	per gross ton lead
	5.75	per gross ton copper

Gulf ports to

Hamburg	$5.00	per gross ton copper, lead and zinc
Liverpool	5.00	
Antwerp	4.50	
Havre	5.25	

Pacific coast ports to

Hongkong	$5.00	per short ton copper and lead
Kobe	5.00	per short ton copper and lead

Lead Bullion (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York	To St. Louis
East St. Louis, Ill.	$7.00	.....
Pueblo, Colo.	12.50	$9.00
Leadville, Colo.	12.50	9.00
East Helena, Mont	12.50	9.50
El Paso, Tex.	10.00 Via Gulf	
	12.00 All Rail	7.00
Omaha, Neb.	9.60	3.65
Murray, Utah	12.50	9.00
Midvale, Utah	12.50	9.00
Tooele, Utah	12.50	9.00
East Chicago, Ill.	6.40	(a) 1.60
Kellogg, Idaho	13.50	9.50
Carnegie, Pa.	3.80	(a) 5.00
Selby, Calif.	(b)	.....
Herculaneum, Mo.	(a) 8.80	(a) 1.80
Federal, Ill.	7.00	(a) 1.80
Collinsville, Ill.	7.00	(a) .75
Granby, Mo.	(a) 10.50	(a) 3.50
Joplin, Mo.	(a) 10.50	(a) 3.50

(a) Pig lead only.
(b) Open rate, via canal.

Slab Zinc

From	Rates per Net Ton to E. St. Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	1.60	6.40
La Salle, Ill.	1.60	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	9.40	12.50
Park City, Utah	9.00	12.50
Amarillo, Tex.	5.80	12.80

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	1.09
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	1.09
	Baxter, Kan.	1.50
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
Sand Springs, Okla.	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
Dewar, Okla.	Cave Springs, Mo.	2.00
Kusa, Okla.	Cent City Spur, Mo.	2.00
Henryetta, Okla.	Chitwood, Mo.	2.00
	Galena, Kan.	1.50
La Harpe, Kan.	Mound City, Kan.	.50
	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
Bartlesville, Okla. (a)	Baxter, Kan.	1.80
	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product: $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	22	.22	.22	.22
Butte, Mont.	Black Eagle, Mont. (a)	....	....	....	....	....	....	....	1.01	....	....	....	....	....	....	1.01
Great Falls, Mont.	Helena, Mont.	....	....	1.50	....	1.69	....	1.91	....	2.36	....	....	....	....	....	2.48
Butte, Mont.	East Helena, Mont.	....	....	1.17	....	1.46	....	1.69	....	2.03	....	....	....	....	....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	....	....	....	....	5.50	6.00	6.70	....	7.40	8.10	8.80
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Pioche, Nev.	Humboldt, Ariz.	....	....	7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	5.50	5.90	....	6.30	....	....	....	7.70
Telluride, Colo.	Durango, Colo.	....	....	....	4.00	....	4.30	....	4.60	5.10	5.60	6.10	....	6.50	7.00	7.50
Silverton, Colo.	Durango, Colo.	....	....	1.40	1.40	....	....	2.20	....	....	....	....	....	2.30	2.55	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	2.30	....	2.60	....	2.90	3.20	....	..	3.80	....	....	4.40
Tyrone, N. M.	El Paso, Tex.	....	....	1.40	1.70	....	2.00	....	2.30	2.60	....	..	3.20	....	....	3.80
Lordsburg, N. M.	Douglas, Ariz.	....	1.00	1.30	1.70	....	2.00	....	2.30	2.60	....	....	3.20	....	....	3.80
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.80	....	2.10	....	2.40	2.70	....	....	3.30	....	....	3.90
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	1.30	.90	1.60	....	1.90	2.20	....	....	2.80	....	....	3.40
Tombstone, Ariz.	El Paso, Tex.	....	1.60	1.90	....	2.50	....	....	3.50	3.80	....	....	4.40	....	....	5.00
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. / Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C. (d)	.30	.30	.30	.30	.50	.70	....	.80	.80	....	....	....	....	....	....
Republic, Wash.	Tadanac, B. C.	....	2.11	2.56	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Plus $2.70 per car switching.
(d) Applicable on ore only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

From	To	Value of Ores and Concentrates: $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho (a) (d)	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	....	.....	....	....	1.02
Burke and Wallace, Idaho	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	.....	4.25	4.50	4.75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	....	....	.....	....	.....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	.....	....	.....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	....	....	4.37½	....	.....	5.12
Park City, Utah	Salt Lake Smelters	1.00(c)	1.10	1.25	....	1.50	....	1.75	....	2.00	....	.....	2.25	....	2.50
Eureka, Utah	Salt Lake Smelters	1.00	1.10	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	1.10	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	1.10	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	.....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	....	....
Goldfield, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Battle Mountain (a)	Salt Lake Smelters	....	....	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Palisade, Nev. (a)	Salt Lake Smelters	2.20	2.60	3.20	....	3.80	....	4.30	4.80	5.30	5.80	.....	6.30	6.80	7.30
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	.....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Golconda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Tonopah, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.00
Rogerson, Idaho	Salt Lake Smelters	2.50	2.75	3.50	....	4.00	....	4.50	5.00	5.50	6.00	.....	6.50	7.00	7.07
Georgetown, Colo.	Leadville, Colo.	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	.....	5.80	5.80	5.85

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
(d) Crude ore for concentration, 30c. per ton.
(e) For $9 value rate is 95c.; $8 values, 90c.; $7 value 85c.; $6 value, 80c.

Mining Stocks—Week Ended November 12, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	49	47⅛	48	Oc.15, No.21 Q	0.75
Arcadian Consol.	Boston	2	1⅞	2		
Ariz. Com'l	Boston	5⅛	5¼	5⅛	Jy. 18, Jy. 30	0.25
Calaveras	N. Y. Curb			1⅞		
Calumet & Arizona	New York	94¼	90	90⅛	Se. 9, Se. 26 Q	1.50
Calumet & Hecla	Boston	17	16⅛	16⅞	Au. 31, Se.15 Q	0.50
Cerro de Pasco	New York	64	61⅞	62	Oc.13, No.1 Q	1.00
Chile Copper	New York	36⅜	35⅜	35⅜	De. 2, De. 30,Q	0.62½
Con. Coppermines	N. Y. Curb	4⅞	3⅞	4⅜		
Copper Range	Boston	15¼	14⅛	14⅛	Ap.2, My.2, A	1.00
Crystal Copper	BostonCurb			*30		
East Butte	Boston	2	1⅜	1⅜	Dec., 1919	0.50
Granby Consol.	New York	35¾	35	35⅛	Jn.15 Jy. 1 Q	1.00
Greene Cananea	New York	85	82	83⅛	Nov., 1920	0.50
Howe Sound	New York	39	37⅛	38⅛	Oc.1, Oc.15, Q	1.00
Inspiration Consol.	New York	19¼	18⅜	18⅜	Ma.17, Ap.4, Q	0.25
Iron Cap	Boston Curb			1⅞		
Isle Royale	Boston	13½	12½	12⅜	Se. 30, Oc. 15, Q	0.50
Kennecott	New York	79⅜	77⅛	79⅛	Se. 2, Oc. 1, Q	1.25
Magma Copper	New York	50⅜	48⅛	50⅛	Se.30,Oc.15 Q	0.75
Mason Valley	N. Y. Curb	*84	*80	*80		
Miami Copper	New York	15⅛	15	15⅛	No.1, No.15, Q	0.37½
Mohawk	Boston	45⅛	44	45	Oc.31, De.1 Q	2.00
Mother Lode Coal	New York	1⅛	1⅛	1⅛	Jn.10, Jn.30	0.25
Nevada Consol.	New York	17	16⅛	16⅛	Se. 16, Se. 30 Q	0.37½
New Cornelia	Boston	23⅛	22⅛	23⅛	No.4, No.21 Q	0.50
Noranda	N. Y. Curb	17	16⅛	16⅛		
North Butte	Boston	1⅛	1	1⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1.00	*89	*95	Sept. 1926	0.03
Old Dominion	Boston	11⅛	10⅜	10⅜	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	116	115	116	Se.21, Oc.1 Q	1.50
Quincy	Boston	15	15	15	March, 1920	1.00
Ray Consolidated	New York			15⅛	Ap.20, Ap. 30	0.25
St. Mary's Min. Ld.	Boston	26⅛	25	25⅞	Fe.10, Ma.10	2.00
Seneca Copper	New York	1⅜	1⅜	1⅜		
Shattuck-Denn	Boston Curb			6⅞		
Tenn. C. & C.	New York	9⅛	8⅞	9⅛	No.30, De.15, Q	0.12½
United Verde Ex	N. Y. Curb	27	26⅛	26⅛	Oc.6, No.1 Q	0.75
Utah Copper	New York			130	Se. 16, Se. 30 Q	1.50
Utah Metal & T	Boston	1⅛	1	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	*43	*41	*41		
NICKEL-COPPER						
Internat. Nickel	New York	68⅛	64⅞	66⅝	Se. 16, Se. 30 Q	0.50
Internat. Nickel pfd.	New York			109	Oc. 13, No. 1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*15¾	*15½	*15½	June, 1927	0.005
National Lead	New York	119¼	118	119⅞	Se. 16, Se. 30 Q	1.25
National Lead pfd	New York	113	112½	113	De.2, De. 15 Q	1.75
St. Joseph Lead	New York	37¼	37	37½	De.10,De.20,QX	0.75
ZINC						
Am. Z. L. & S.	New York	5¾	5¾	5¾	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	38	35½	36	No7., 1920	1.50
Butte C. & Z.	New York	4	3¾	3¾	De. 9, De. 24	0.50
Butte & Superior	New York	8⅜	8⅛	8⅛	Se. 16, Se. 30 Q	0.50
Callahan Zn-Ld	New York	1⅛	1⅛	1⅛	Dec., 1920	0.50
Consol.Lead&Zinc'A'	St. Louis	11	11	11	Ma.15, Ap.1 Q	0.25
Eagle-Picher	Cincinnati	25	24¼	24⅞	No.15, De.1 Q	0.40
Eagle-Picher pfd.	Cincinnati			117½	Jn.30, Oc.15 Q	1.50
New Jersey Zn	N. Y. Curb	183¼	182	183¼	No. 19, De. 10 X	2.00
United Zinc	N. Y. Curb			*55		
Yellow Pine	Los Angeles	*38	*38	*38	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York			1⅛		
Argonaut	Toronto	*40⅜	*37	*37½		
Barry-Hollinger	Toronto	*95	*90½	*95		
Con.W.Dome L.new.	Toronto	*16	*15	*15½		
Cresson Consol. G.	N. Y. Curb	1⅞	1⅛	1⅛	Se. 30, Oc.10 Q	0.10
Dome Mines	New York	11⅛	10⅜	10⅜	Se.30, Oc.20 Q	0.75
Golden Cycle	Colo.Springs	†1.74	†1.73		Au.30, Se.10 Q	0.04
Hollinger Consol.	Toronto	17.65	17.25	17.45	No. 16, De. 2	0.10
Homestake Mining	New York	71⅛	71	71	No.19, No.25 M	0.50
Kirkland Lake	Toronto	2.93	2.70	2.93		
Lake Shore	Toronto	26.50	25.25	26.30	Se.1, Se.15 X	0.20
McIntyre-Porcupine	New York	28	27¼	27⅞	No.1, De.1 Q	0.25
Portland	Colo.Springs	†*25	†*16		Ap.6, Ap.15, Q	0.02
Rand Mines	New York			48⅛	Au.22-29 Am.Sh.	1.52
Teck-Hughes	Toronto	10.85	10.60	10.75	Jy.21, Au.1	0.10
Tom Reed	Los Angeles	*30	*28	*28	Dec., 1926	0.02
Tough-Oakes	Toronto	*59	*55	*58		
United Eastern	N. Y. Curb			*50	July, 1924	0.05
Vipond Cons.	Toronto	*80	*58	*75	Apr.1, Apr.15	0.03
Wright-Hargreaves	Toronto	7.45	6.95	7.10	Oc.17, No.1	0.05
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	12	12	12		
Con. Cortez	N. Y. Curb	*21	*18	*18		
Dolores Esperanza	N. Y. Curb			*42	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Se. 15, Oc. 4	0.08
Tonopah Belmont	N. Y. Curb			1⅛	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb	*17	*17	*17	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb			1⅛	Se.20, Oc.21	0.07½
West End Consol.	N. Y. Curb			*7	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*74	June, 1918	0.02
SILVER						
Beaver Consol.	Toronto	2.36	2.10	2.36	May, 1920	0.03
Castle-Trethewey	Toronto	*87	*80½	*85		
Coniagas	Toronto	4.50	4.35	4.50	May, 1924	0.12½
Keeley	Toronto	*82½	*80½	*80	Se.1, Se.15	0.08
Lorrain Trout Lake	Toronto			*60	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*17½	*17	*17	Oct., 1920	0.03
Mining Corp. Can.	Toronto	4.05	3.75	3.98	Jn. 29, Jy.15	0.12½
Nipissing	N. Y. Curb	7¼	6⅞	6⅞	Se.30, Oc.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅜	3½	3½	Ma. 25,Ap.4,QX	0.12½
Bingham Mines	Boston			58½	Se.24, Oc.5 Q	1.00
BunkerHill&Sullivan	N. Y. Curb	134½	125	134⅜	Oc. 31, No.4	0.75
Cardiff M. & M.	Salt Lake	*96	*86	*87	Feb. 5, 1927	0.10
Chief Consol.	Salt Lake	1.97½	1.90	1.90	Nov., 1926 Q	0.10
Consti'nMng.&Mill'g	Spokane	*15	*15	*15		
Erupcion	Boston Curb			*60	Se. 15, Oc 3 Q	0.07½
Eureka Lily	Salt Lake	1.27½	1.25	1.27½		
Federal M. & S.	New York	156	145	151	Jn.25, Jn.29 Spec.	$10
Federal M. & S pfd.	New York	96½	95½	95¼	Au. 25 Se 15 Q	0.25
Hecla Mining	N. Y. Curb	16⅜	16¼	16⅜	No 15, De.15 Q	1.75
Highland-Surprise	Spokane	*11½	*11	*11		
Iron King Mining	Salt Lake	*50	*49	*49		
Keystone Mining	Salt Lake			*21	Au. 12, Au. 26	0.07½
Lucky Jim	Spokane	*35½	*31½	*32¼		
Lucky Tiger-Com	Kansas City	†7.15	†7.00		Oc.10, Oc. 20	0.05
Mammoth Mining	Salt Lake	1.80	1.80	1.80	Jn.10, Jn.20 Q	0.05
Marsh Mines	Spokane	1.00	*75	1.00		
North Lily	Salt Lake	3.10	2.90	3.10		
Park Utah	New York	7¼	7⅛	7⅛	Se. 15, Oc. 1 Q	0.20
Plutus Mining	Salt Lake			1.40	Oc. 25, No. 10 Q	0.10
San Rafael	San Fran.	*7½	*6	*6		
Silver King Coal	Salt Lake	10.00	9.90	10.00	Se. 20, Oc. 1 Q	0.25
Silversmith	Spokane	*16	*15	*15¼	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*48½	*45	*47½		
Sunshine M. Co.	Spokane	1.16	1.10	1.16		
Tamarack-Custer	Spokane	*41	*34	*34½	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.12½	11.87½	12.12½	Se.15, Se.29 QX	0.40
Utah-Apex	Boston	4⅛	4⅛	4⅛	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	54	51¼	54	Se. 2, Oc. 1.	1.75
Cleveland-Cliffs Iron	Cleveland	99	95	99	Oc. 15, Oc. 25 Q	1.00
Colorado Fuel & Iron	New York	75⅞	70⅛	75⅞	May, 1921	0.75
Gt. North'n Iron Ore	New York	25½	23½	23½	Dec. 6, Dec. 28	0.75
Inland Steel	New York	52½	51	52½	No. 15, De. 1 Q	0.62½
Replogle Steel	New York			12½		
Republic I. & S.	New York	57½	56⅞	57½	No. 15, De 1 Q	1.00
Republic I. & S. pfd.	New York	99½	99¼	99¼	De. 14, Ja. 2 Q	1.75
Sloss-Sheffield S. & I.	New York	115	110½	115	De. 10, De. 20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	106⅞	106⅞	106⅞	De. 20, Ja.3 Q	1.75
U. S. Steel	New York	139⅞	134½	139⅞	No. 30, De. 30 Q	1.75
U. S. Steel, pfd.	New York	138⅛	136½	138	Oc.30, No. 29 Q	1.75
Virginia I. C. & C.	New York	38	38	38	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York			60½	Ju. 15, Jy. 1	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York			7⅛	Jn. 26, Jn.30	1.45
So. Am. G. & P. New.	N. Y. Curb	2⅜	2⅛	2⅛		
Alum. Co. of Amer.	N. Y. Curb	96¾	96⅛	96⅛		
Alum. Co. of Amer.pf.	N. Y. Curb	104¼	104⅛	104⅛	Se. 15, Oc 1 Q	1.50
Vanadium Corp.	New York	51⅝	50⅛	51⅛	No. 1, No. 15 Q	0.75
Patino M. & E.	New York	20⅛	19⅞	19⅞	Ap. 27, My. 5	1 sh.
ASBESTOS						
Asbestos Corp.	Montreal	49	37	37⅛	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	94	93¼	94	Se.30, Oc.15 Q	1.75
SULPHUR						
Freeport, Texas	New York	92⅛	89⅜	91⅞	Oc.15, No.1 QX	1.50
Texas Gulf	New York	74⅛	70⅛	74⅛	Ju. 1, Ju. 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	39	38⅛	39	No.19, De.1 Q	0.75
Amer. Metal, pfd.	New York			110	No.19, De.1 Q	1.75
Amer. Sm. & Ref.	New York	173½	168	172½	Oc.14, No. 1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	129½	128½	129½	No., Dec. Q	1.75
Consol. M. & S.	Montreal	250	245	245	Jn. 30, Jy. 15 X	6.25
Newmont Mining	N. Y. Curb	110⅛	105½	110	Se.30, Oc.15 Q	1.00
U. S. Sm. R. & M.	New York	39½	37½	38½	Oc. 6, Oc. 15 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	49	49	49	Oc. 6, Oc. 15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

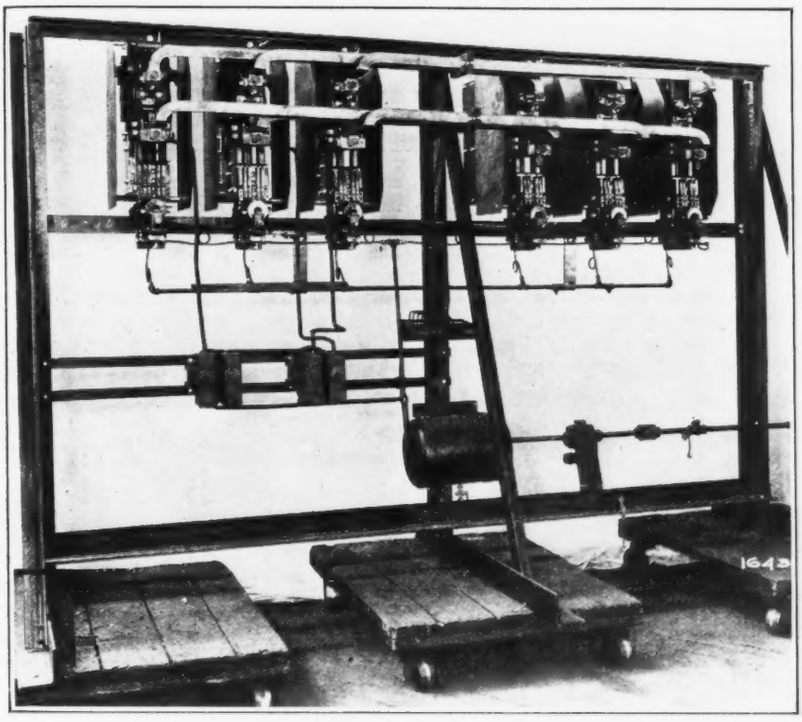
Boston quotations courtesy Boston Stock Exchange: Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED NOV. 1, 1927

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	75/7½	75/—	75/—	Nov., 1927	5	p.c. (†)
British Platinum (£1)	—/9	—/6	—/6	Feb., 1925	2½	p.c.
Burma Corpn. (10 rupees)	13/3	12/9	13/—	Aug., 1927	6	annas*
Bwana M'Kubwa (5s)	5/—	4/4½	4/6			
Camp Bird (2s)	3/6	3/3	3/6			
El Oro (£1)	4/4½	3/10½	4/3	Nov., 1924	2½	p.c.*
Esperanza (10s)	—/2	—/2	—/2			
Frontino & Bolivia (£1)	14/9	13/9	13/9	July, 1927	5	p.c
Mexican Corpn. (£1)	8/6	7/10½	8/6			
Mexico Mines of El Oro (£1)	18/9	15/—	18/9	Dec., 1926	3¾	p.c.*
N'Changa Copper Mining	11/6	10/—	11/6			
Oroville Dredging (£1)	6/6	6/—	6/3	Dec., 1923	3¾	p.c.
Ouro Preto (£1)	2/6	2/3	2/6	May, 1925	2½	p.c.
Rhodesian Congo Border (£1)	46/—	41/—	42/6			
St. John del Rey (£1)	10/9	10/4½	10/6	May, 1927	3¾	p.c.
San Francisco Mines (10s)	28/—	27/9	27/9	July, 1927	15s.	
Santa Gertrudis (£1)	18/—	17/—	17/6	July, 1927	7½	p.c
Selukwe (2s. 6d.)	7/3	6/6	7/—	April, 1917	6¼	p.c
S. Amer. Copper (2s.)	2/—	1/—	2/—	Nov., 1917	75	p.c
Tanganyika (£1)	60/6	57/3	57/6	Aug., 1927	7½	p.c.
Union Miniere du Haut-Katanga (Brussels)	9.690	9.500	9.690	July, 1927	182.60	(‡)

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Industrial Progress



Rear view of a high-voltage electro-pneumatic reversing switch group equipped with alternating-current magnet valves for mine-hoist service

New A.-C. Magnet Valve Developed for Mine Hoist Control

An alternating-current magnet valve for operation of electro-pneumatic unit switches has been developed by Westinghouse. Heretofore only direct-current magnet valves have been available, thus requiring direct current for operation of the magnet valves and control circuits. This important development permits the use of alternating current control circuits, and, by eliminating the small motor-generator formerly required, the cost of the complete electro-pneumatic control for mine hoists is materially reduced, according to the company's announcement.

This Trolley Splicer Better, Maker Claims

ADVANTAGES over trolley splicers thus far marketed is claimed for a new splicer (the MCM) just introduced by the Ohio Brass Co., Mansfield, Ohio. First, it is said to have holding power in excess of the breaking strength of new wire, and to have setscrews placed at such an angle as to cause the tension of the trolley wire to tighten the hold of the splicer.

It is also claimed that the new splicer makes installation easier and speedier, and thus saves time and work. It is designed to receive the wire in a straight line, and thus does not necessitate the forming of the wire so often required with other splicers. It is easy to apply, because, with no center obstruction, all that has to be done is to slip it back over the wire, measure the slack in the wire, cut the wire to the right length, connect the ends, slip the splicer over the other wire, and, finally, tighten the setscrews. The splicer is then ready for use.

The manufacturer also claims that this splicer is easy on the wire, because it causes very little arcing. It requires no peening, because a perfectly smooth underrun is made sure by lips which grip the wire closely. The splicer is also readily removed, should occasion demand, as the setscrews are always intact and in working shape. The heads of the screws cannot be wrenched off, and, being galvanized, will not rust and freeze in their seats. The new splicer is made of heavy cast bronze and may be had for use with 2-0, 4-0, and 6-0 round or grooved wire, and 4-0 Fig. 8 wire.

An improved trolley splicer. Its grip is stronger than the breaking strength of the wire

This 95-Lb. Portable Pump Will Handle 7,500 Gal. Per Hour

A new portable centrifugal pumping unit weighing 95 lb. and having a capacity of 7,500 gal. per hour is being marketed through dealers by the Homelite Corporation, Port Chester, N. Y. It consists of a high-efficiency centrifugal pump with bronze open-type impeller direct-connected to a 1½-hp. single-cylinder, air-cooled motor operating on gasoline or kerosene. The pump is said to have been tested extensively in unwatering excavations, in filling tanks and boilers, and for other similar purposes.

The pump and engine are mounted on the same base, which also acts as a fuel tank, holding 1 gal., which is sufficient to operate the engine for four or five hours. The single shaft runs on Norma Hoffman ball bearings of a size larger than necessary.

Suction and discharge are 2 in. in diameter. The lift is 20 ft., and the head, 45 ft. The pump will handle muddy, gritty water, oils, chemicals or anything that will pass through the foot-valve strainer.

Inasmuch as the engine is air-cooled, the outfit is independent of cooling-water supply and can be used even in the lowest temperatures. Ignition is supplied by a Robert Bosch high-tension, damp-proof magneto.

Portability is possible not only because of the low weight of 95 lb., but because the unit can be set anywhere without need for foundations, skids, or blocking. Ingeniously conceived spring feet result in stability and absorption of vibration.

Small Reversing Switches for Varied Use

Three small switches for miscellaneous use as across-the-line reversing switches for small motors have been announced by the General Electric Co. They bear the designations CR-7009-F-1, F-2, and B-10.

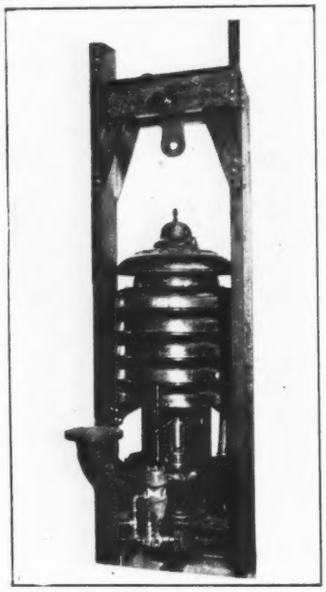
The CR-7009-F-1 and F-2 switches each consist of two 15-ampere, double-pole contactors electrically and mechanically interlocked and inclosed in a drawn-shell inclosing case. They are for use with momentary-contact push-button stations. The F-1 form is without overload relays: Form F-2 has Trumbull overload relays.

The CR-7009-B-10 switch consists of two three-pole, 25 amp. contactors, mechanically and electrically interlocked. The switch is for use with a momentary-contact push-button station and has Trumbull overload relays.

All these switches are inclosed in a new type, drawn-shell inclosing case. They can be used wherever a small magnetic reversing switch is required, typical applications being machine tools, motor-operated valves, motor-operated windows, and doors.

Mine Dewatering Pump Has Unique Features

DEWATERING of the Wallower mine, at Leadville, Colo., is being accomplished by means of a Pomona centrifugal turbine pump installed to a depth of 750 ft. The pump is of stock



Centrifugal turbine pump manufactured for dewatering a Colorado mine. View shows construction of framework which supports pump and column so that entire assembly can be lowered in mine shaft as water level recedes. Direct-connected motor is protected by housing and is connected to the pump above the bowls. Bearings and pump heads are directly below motor.

design, built by the Pomona Manufacturing Company at Pomona, Calif., but has unique features. Water lubrication is embodied and a booster unit is an integral part of the pump, thus making unnecessary the use of an auxiliary unit.

The entire pump unit is suspended on cables so that it can be lowered as the water level recedes. Two hundred feet of column are suspended below the bottom of the pump head. A set of 5-stage 12-in. turbine bowls has been installed at the bottom of the column to raise the water to the bottom of the pump head, at which point a 12-stage 12-in. turbine boosts the water to the surface.

The pump has a capacity of from 500 to 650 gal. per minute against a total head of from 600 to 750 ft., according to W. H. Day, vice-president of the company.

The water in the Wallower mine is rather acid, and all of the bowls and shaft have been made of non-corrosive material. Also, the column was coated with biturine, for the same purpose.

Use of water lubrication, although it is a regular feature in all turbine pumps of the same make, is recognized as a unique feature, in that it supplants oil below the surface. The bearings are lubricated by water entirely, making unnecessary any oil conduits or lubricating chambers below the surface. Any sand or grit that enters the bearings is readily washed out, and sand-cutting is overcome to the greatest extent, according to the manufacturers.

Co-operating with the company, the United Iron Works, of Kansas City and Joplin, Mo., assisted in handling the details pertaining to the order.

A pump of similar construction was recently shipped from the Pomona factory to the Standard Oil refinery at Baton Rouge, La. Its performance was found to be so satisfactory that an order for a duplicate pump of larger capacity was placed with the company, according to Mr. Day.

The Witwatersrand's Choice in Rock Drills

The accompanying tables appeared in the *South African Mining and Engineering Journal* of Sept. 24. The statement was compiled by the Mines Department. It shows the number and types of drill in use during December, 1926. The 7,780 drills in operation represent an increase of 664 since the previous year, when the figure reported was 7,116. Of the 7,780 drills only 234 were "dry" machines. The second of the two tables, at the bottom of the page, gives figures for the last seven years.

Rock Drills in Use in Rand Gold Mines

Name of Maker and Maker's Type or Symbol	Diameter of Piston.	Piston or Hammer.	Method of Sludging: Using Solid Steel.	Method of Sludging: Water Only Through Steel.	Method of Sludging: Air and Water Through Steel.	Total Number in Operation.	Fitted With Front-headed Air Release.	Fitted With Long Piston.	Fitted With Outside Water-feed Direct to Jumper.	Fitted With Other Dust-prevention Device Altering Standard Type.
Atlas Drill Company:	In.		No.	No.	No.	No.	No.	No.	No.	No.
Atlas Cradle Hammer R. W. 64	2½	Hammer	...	108	...	108	.....	...	24	...
Cyclop 50	2	Hammer	...	12	...	12	.....	...	12	...
Cyclop 60	2¾	Hammer	...	1	...	1	.....	...	...	...
Climax Rock Drill & Engineering Works, Ltd.:										
Imperial	3½	Piston	30	.....	...	30	.....	...	...	...
Johannesburg No. 3	2¾	Hammer	...	41	...	41	28	29	...	...
Hydromax	2 7/8	Hammer	...	36	...	36	.....	...	6	...
Hydromite	1¾	Hammer	...	21	...	21	19	...	2	...
S.J. 114	2¾	Hammer	...	46	...	46	46	...	...	...
S.J. 114, Mk. IV	2¾	Hammer	...	51	...	51	51	...	...	...
C.L.D.	3	Hammer	...	200	14	214	214	...	...	3
C.H.D.	4	Hammer	...	18	...	18	18	...	...	...
C.X. Climax jackhammer	2¾	Hammer	...	68	3	71	71	...	...	...
Consolidated Pneumatic Tool Co., Ltd.										
C.P. mounted drifter	3	Hammer	...	172	28	200	200	...	...	2
C.P. 10 W	2¼	Hammer	...	78	4	82	82	...	...	...
Delfos, Ltd.:										
Delfast D, 25	2¾	Hammer	...	83	...	83	82	...	...	23
Denver Rock Drill & Machinery Co., Ltd.:										
Model 37 Turbro Waughhammer	2¾	Hammer	..	154	25	179	179	...	...	...
Model 337 Turbro Waughhammer	2¾	Hammer	...	73	...	73	69	...	...	...
Model 7a, Waugh light drifter	3½	Hammer	..	17	...	17	17	...	...	...
Model 17a, Waugh heavy drifter	4	Hammer	...	3	2	5	5	...	...	...
Holman Bros., Ltd.:										
H.D. 2	2 1/16	Hammer	12	.....	...	12	.....	...	...	...
C.H. 2	2¾	Hammer	...	393	...	393	259	321	...	73
A.F.W. 2	2	Hammer	...	258	...	258	74	...	97	...
H.W. 2	2 5/16	Hammer	..	6	24	30	.....	...	19	...
Holman light drifter	3½	Hammer	..	48	...	48	48	...	...	...
W.L.B. (50 pounder)	2¾	Hammer	...	526	14	540	537	...	3	3
W.L.B. standard jackhammer	2¾	Hammer	...	1,006	45	1,051	1,051	...	...	7
Ingersoll-Rand Co., (S.A.) Ltd.:										
B.C.R. 430	2½	Hammer	192	.....	...	192	.....	...	...	...
B.A.R. 33	2¾	Hammer	...	.....	...	.....	.....	...	...	...
Leyner 18a	2½	Hammer	...	405	13	418	397	292	...	4
Leyner R.B. 71	3	Hammer	...	13	...	13	6	7	...	...
C.C.W. 21	1¾–2¼	Hammer	...	56	...	56	.....	...	...	...
B.C.W. 22	2	Hammer	...	39	...	39	38	...	...	...
B.C.R.W. 430	2¾	Hammer	...	378	101	479	367	...	46	6
D.C.R.W. 23	2¾	Hammer	...	2,518	100	2,618	2,559	12	34	76
X. 70 drifter	4	Hammer	...	56	12	68	62	56	...	...
N. 70 drifter	3½	Hammer	...	114	...	114	104	...	...	23
R. 72 ..... Differential	2½–3½	Hammer	...	1	...	1	1	...	...	...
Sullivan Machinery Co:										
D.W. 64	3½	Hammer	...	25	...	25	25	...	...	...
D.P. 331 rotator	2½	Hammer	...	137	...	137	137	...	16	...
Total drills			234	7,161	385	7,780	6,746	717	259	220

December	Total in Operation	"Dry" Machines — Number	"Dry" Machines — Percentage	"Wet" Machines — Number	"Wet" Machines — Percentage
1919	5,596	5,902	61.5	3,694	38.5
1920	8,454	4,491	53.1	3,963	46.9
1921	8,018	3,563	44.4	4,455	55.6
1922	7,494	2,794	37.3	4,700	62.7
1923	7,647	1,729	22.6	5,918	77.4
1924	7,416	834	11.2	6,582	88.8
1925	7,116	397	5.6	6,719	94.4
1926	7,780	234	3.0	7,546	97.0